Modern Refrigeration & Air Control

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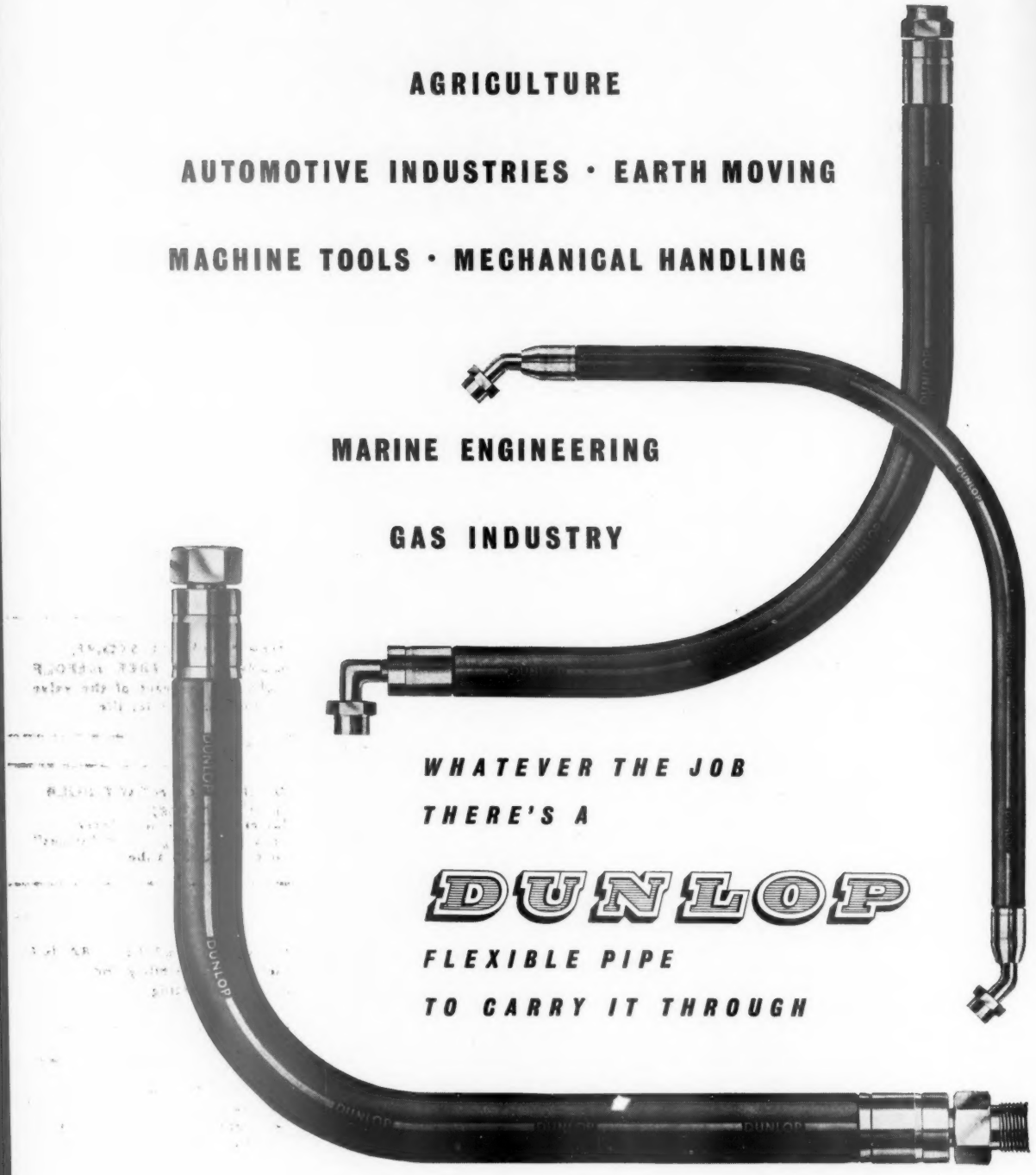

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MODERN REFRIGERATION

and Air Control News

Incorporating
COLD STORAGE AND PRODUCE REVIEW
and ICE AND COLD STORAGE

Established 1898

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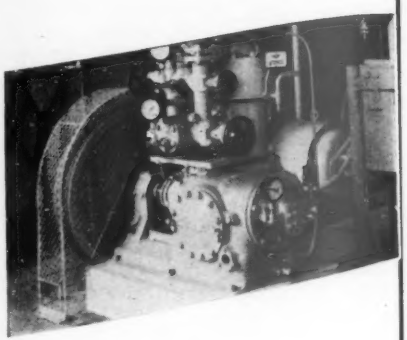

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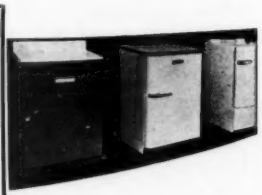

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VOLUME 61 NUMBER 722

May . 1958

Editorial . . . .

A Good Season Ahead

Mechanical Handling

Refrigerated Shipping

● The tonic administered to the domestic refrigeration industry by the Chancellor of the Exchequer's purchase tax relief in April has already put new heart into this important section of the trade, a view confirmed by many of its executives in our columns this month (see page 474).

● The main contention of those bodies who have striven for the abolition of this tax has been, of course, that Britain, with only 10 per cent. of her homes fitted with this vital piece of equipment, could not compete economically in the export market with those countries which had a stronger home demand. While it is a little late in the season for a reassessment of sales policies, the wise manufacturer will, no doubt, still keep his eye well and truly on the export target; it would indeed be a tragedy if shipments overseas fell short of expectations. If this summer season should see new records created at home *and* overseas, perhaps Mr. Heathcoat Amory could be persuaded to do something in the autumn about that remaining 30 per cent. tax. Meantime, the B.R.A. and its combat unit, DoRDec, are to be congratulated on their efforts in this P.T. fight. "M.R." likes to think that its own exertions, too, have not been in vain.

● It is said by some that the day of the brawny, muscle-bound industrial worker is passing. No longer need the man who lifts, carries and stacks heavy loads be a present-day Hercules skilled in the science of weight-lifting. Thanks to mechanical handling he can now make child's play of the toughest job, often by merely touching a button. An ingenious labour-aiding device which made its début at the Mechanical Handling Exhibition at Earls Court this month quickly and effortlessly carries out tasks which formerly took hours of backbreaking drudgery to accomplish . . . and it can be moved about as easily as pushing a wheelbarrow. The machine, powered by a "plug-in" electric motor or a small petrol engine, can repeatedly lift loads weighing up to 2½ cwt. to a height of 10 ft. The sack, carton or similar load is placed on a platform which lifts automatically and halts at any desired level. Immediately one load is removed, the platform returns ready to receive the next. The lifter counts as it works and can be set to stop when any predetermined number of loads has been lifted. Its applications in the industrial scene are practically unlimited. This single example from the vast display of labour-aiding machinery and equipment to be seen at the exhibition (May 7 to 17) represents only one way in which mechanical handling can speed production and reduce cost and effort in every branch of industry. The cold storage industry is only now awakening to the benefits of this type of equipment but it is to be hoped that acceptance will henceforth be accelerated.

● Although the world's fleets of refrigerated ships were quickly brought back to strength in the immediate post-war years, it is interesting to learn that during 1957 some 95 new refrigerated cargo installations, comprising 5,500,000 c.ft., were completed to Lloyd's Register survey, and at December 31, 109 refrigerated ships were in hand or on order. Of these, 40, comprising 6,000,000 c.ft., were being built in the United Kingdom and the remaining 69, totalling 3,500,000 c.ft., overseas. Dealing with this work, in addition to the refrigeration staff at head office, were 10 specially trained surveyors stationed at the larger building ports. These facts are contained in the annual report of the society lately to hand. Plans and specifications for a small number of new cold stores and extensions to existing classed cold stores were dealt with during the year, and particulars of some existing cold stores were submitted with a view to survey for classification. Applications were received for the survey of two cold stores in Hamburg.

● Refrigeration's application to artificial insemination is receiving considerable attention at home and abroad. In conjunction with the Milk Marketing Board, a Loughborough firm (Metalcraft Ltd.) has been assisting with the movement, at low temperatures, of T.B. free artificial insemination semen for cattle, both here and overseas. Great strides have been made in recent years which have benefited breeders all over the world. This technique has been made possible mainly through the use of refrigeration, both in bulk storage and in transit. Satisfactory results have been achieved from consignments sent as far as Australia and New Zealand, a service which has been going on since 1950. It is surprising to note that it is necessary to maintain a temperature of –75° C. to –77° C. at all times when the semen is in the depot bank, and even after shipment by air to New Zealand after 120 hours the temperature is not

allowed to rise above –72° C. Any rise in temperature causes deterioration, and once the temperature is raised to normal values it must be used immediately. Cabinets have been constructed in capacities ranging from 200 to 25,000 ampoules, and the service is increasing.

● Special containers for transporting the semen by air over long distances are made to give maximum insulation with the minimum weight, in order to keep the air freightage to a minimum. Here plastic insulants have come into their own, expanded polystyrene being greatly favoured. It is now possible for any breeder to nominate a particular bull in any part of the country to assist in improving his own stock. This great advantage is coupled with the fact that the " bank " is able to supply semen from a particularly good bull long after its useful life—and even after its death.

● Refrigeration equipment was given maximum presentation at Scotland's Food Exhibition in the Kelvin Hall, Glasgow, over the period April 8 to 19 —not only in the shows put on by the refrigeration firms personally but on virtually every other stand, since cooling plant of one form or another was used by most of the exhibitors to stage their shows. On the essentially equipment side of the show, excellent displays were arranged by Sterne, Frigidaire (Turner & Co. (Glasgow) Ltd.), Prestcold (Wm. Kemp & Co. (Refrigeration) Ltd.), Hussmann (G.A.B. Davidson) and the South of Scotland Electricity Board.

Correspondence

To the Editor,
MODERN REFRIGERATION,
London, S.E.1.

Fires in Cold Stores

Sir,—We have read Mr. Saunders's recent letter on fires in insulated cold stores and would like to put the subject of the use of bitumen in thermal insulation into rather more reasonable perspective.

It is our understanding that :—

(1) Bitumen was not used in the vapour sealing or erection of the insulation at Smithfield.

(2) Bitumen is no more combustible than many materials used in normal building practice. Wood, for instance, chars below 200° C. and at about 250° C. evolves flammable gases and vapours which will support combustion. The type of bitumen used in cork erection has a fire point well above 250° C. In the insulation field, cork—from the rather meagre information available—behaves in much the same way as wood.

(3) Bitumen will only melt and run if present in relatively thick films—the film thickness between cork slabs when used in their erection is only of the order of 0·04 in. Capillary attraction alone would prevent such a thickness from dripping.

(4) While, for really low-temperature work, it is irrefutable that the excellent vapour sealing properties of bitumen make its use on the cold side of a vapour seal apparently unsuitable, it may be pointed out that by suitable processing its permeability can be increased from 1×10^{-8} gm./cm./sq. cm./hr./mm. Hg to over 100×10^{-8} gm./cm/sq. cm./hr./mm. Hg, which, at a thickness of the order of 1/10 in., is not far removed from ¾ in. of sand/cement. Such processed bitumens are incidentally the basis of certain roof waterproofing systems, which, when tested according to B.S.476 surface spread of flame test, fall in class II—surfaces of low flame spread.

It is, therefore, our contention that, where bitumen is used in conjunction with cork, the fire hazard is not increased, and that by suitable selection of the bitumen used, the permeability of a bitumen adhesive/cork system does not entail a risk of water vapour condensation in the insulation itself.

Yours, etc.,
Field House, for BERRY WIGGINS & Co., LTD.,
Fetter Lane, *Technical Department,*
London, E.C.4. R. P. BELL,
March 31, 1958. *Director.*

* * *

To the Editor,
MODERN REFRIGERATION,
London, S.E.1.

Sir,—It gave me great pleasure to notice to-day that twice as many volumes of your journal have been printed to date as I had been reading. To me, as a reader, it means that I have achieved a 50 per cent. efficiency on which I hope to improve as I am growing older. For you, as an editor and publisher, it means that you have been 100 per cent. efficient. On this achievement, initiated and built up by your late father, and actively followed up by you, I would like to congratulate you.

Wishing you and MODERN REFRIGERATION a long life and continuation of its success,

Yours, etc.,
18, Upper Grosvenor Street, Dr. F. L. LEVY.
London, W.1.
April 21, 1958.

Monsanto Chemicals Ltd. and R. H. Cole & Co. Ltd. have come to an agreement under which Monsanto acquire, as an investment, 50 per cent. of the ordinary share capital of R. H. Cole & Co. Ltd. R. H. Cole & Co. Ltd. is a private company engaged in the marketing of raw materials and equipment to the plastics, chemical and electrical industries. It will remain as a separate entity under its own board of directors, with Mr. R. Hugh Cole and Mr. Peter H. Cole continuing as joint managing directors.

* * *

Mr. R. Sydenham, well known in polystyrene circles, has left London to take up duties in the U.S.A. He has been associated with the development of this new insulant since almost the inception of this material in 1955 and has been concerned with its establishment for nautical, display and other uses. We wish him continued success overseas.

NEWS OF THE MONTH

Refrigeration and A-c. Exports.—During March 1958 air-conditioning and refrigerating machinery (commercial and industrial sizes) to the value of £852,128, weighing 1,288 tons, was exported from the United Kingdom. Comparable figures for March 1957 were 1,314 tons, worth £867,068.

* * *

Exports' Analysis.—Of the 1,288 tons of air-conditioning and refrigerating plant worth £852,128 exported by Great Britain in March—quoted in the preceding paragraph—43 tons went to the Union of South Africa, 70 tons to India, 32 tons to Australia, 73 tons to New Zealand, 123 tons to Canada, 279 tons to "other Commonwealth countries," 42 tons to Eire, 24 tons to Sweden, 40 tons to Western Germany, 25 tons to the Netherlands, 85 tons to Belgium, 76 tons to France, 62 tons to Italy, and 314 tons to "other foreign countries".

* * *

Exports of Small Refrigerators.—During March, 1,717 tons of complete refrigerators (domestic) (including complete mechanical units) were sent overseas from Great Britain. These exports were worth £982,809. The 1,717 tons comprised 112 tons to the Union of South Africa, 19 tons to Rhodesia and Nyasaland, 6 tons to India, 49 tons to New Zealand, 780 tons to "other Commonwealth countries, 10 tons to Sweden, 75 tons to Western Germany, 49 tons to the Netherlands, 83 tons to Belgium, 117 tons to Italy, and 417 tons to "other foreign countries".

* * *

B.R.A. Officers.—At the annual general meeting of the British Refrigeration Association, Mr. E. G. Rowledge (The Pressed Steel Co. Ltd.) was elected chairman of the Association and Mr. J. A. Howie (The Lightfoot Refrigeration Co. Ltd.) was elected vice-chairman.

* * *

Refrigerator Sales in 1957.—According to the Electricity Council, area electricity boards in England and Wales sold 50,030 electric refrigerators during the 12 months to December 31, 1957. This represented an increase of 55·8 per cent. over the previous year.

Apples in Gas Storage.—At a members' day held at East Malling Research Station, attended by over 300 persons, it was stated that gloeosporium on Cox apples from all parts of the country which were kept in stores at the station was slightly higher this year than last, but apples from scrubbed gas storage showed no greater amount of rotting than had been found in cold storage samples, in spite of being taken out of store a month later. As regards market condition, they were in a better state. Dr. H. B. S. Montgomery outlined the plans for carrying on the experiments for another year, with special comparisons of the effects of rate of applied nitrogen. He proposed to use a lower cold storage temperature and a longer period of gas storage to bring out differences in storage life apart from wastage due to rotting, and to compare the behaviour of samples from different farms when artificially subjected to a uniform spore-load of gloeosporium.

* * *

Cryogenic Engineering Conference.—"M.R." is informed by Mr. K. D. Timmerhaus, secretary, cryogenic engineering conference, chemical engineering dept., University of Colorado, Boulder, that the 1958 cryogenic engineering conference will be held at the Massachusetts Institute of Technology on September 3, 4 and 5. Technical papers and discussions will deal with engineering research and development at very low temperatures. The following topics are planned (others will be added if desired): (*a*) Cryogenic processes—liquefaction cycles, purification of gases, gas separation, distillation, heat transfer, catalysis, fluid flow, absorption; (*b*) Cryogenic applications—Lox production, cryogenic fuels, oxidants, and pressurants; (*c*) Cryogenic equipment—liquid level probes, pumps, bearings, transfer lines, dewars, cryostats, temperature and pressure measuring devices, expansion engines and turbines, heat exchangers, regenerators; (*d*) Cryogenic properties—mechanical, electrical, thermal, vacuum insulation, powder insulation, safety, friction studies, vapor-liquid equilibria. Delegates planning to present papers at the 1958 Cryogenic Engineering Conference are reminded that the deadline for abstracts (not over 200 words) will be June 1. It is emphasized that papers to be presented should deal only with the technical aspects of cryogenic engineering in the field below 150° K (–190° F.).

" For the third year in succession we are able to report an increase in the trading profits, this year's figure of £767,000 being £229,000 higher than last year which again showed an increase of £61,000 above the year before that," said the chairman at the 59th ordinary general meeting in London of J. & E. Hall Ltd. " The profits now reported are the highest in the history of the company and are the result partly of the new methods to improve the efficiency of management and production, mentioned in my statement last year, and, above all, of an increase in output which may be exceptional. The output in our case cannot be measured by tonnage delivered as in the case of some other industries ; but in every form of business output and margins are inter-related. The greater the volume of business the greater is the amount over which fixed and semi-variable expenses can be spread. We provide technical and other services with the highest efficiency for the benefit of our customers. This necessarily involves a high fixed cost structure and as a consequence there may be pronounced changes in profits from time to time varying with the volume of output," said Col. Gordon.

PICTURE OF THE MONTH

The "Atomium," symbol of the Brussels International and Universal Exhibition, comprises nine 29 m. diameter interconnected spheres and represents an elementary crystal of iron on a scale of 150,000,000,000. The top sphere is a restaurant reached by high-speed lift while the other globes are exhibition spaces. A large air-conditioning plant serves this exhibit, details of which will appear next month.

Mechanical Handling "Comes into its Own" at New Hull Cold Store

Lofty Chambers Allow Efficient Stacking

A NEW cold store recently constructed for Andrew Johnson Knudtzon, Limited, in association with J. Marr & Son, Limited, and Chr. Salvesen & Co., in Walcott Street, Hull, gives the perfect answer to any persons sceptical of the applicability of mechanical handling methods to such a building.

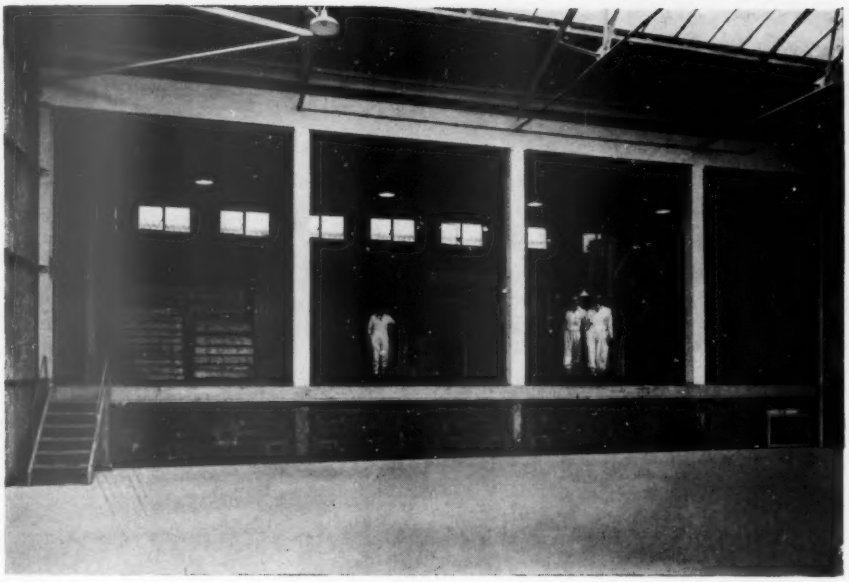
This cold store embodies features never before employed. It has been built principally for the benefit of the fish trade of Hull and is a common store for general use by the fish trade and others. Its present capacity is 2,000 tons and there is space for further development.

The store has been built to maintain a temperature of –20°F.

One of the main features of the store is that all operations are conducted at lorry height. The floor is suspended at a height of 4 ft. on sleeper walls. It is believed that this is the first time that this method has been used in a sub-zero cold store constructed in this country, and all loads going into the store are palletized and mechanically handled throughout. This is the first considerable attempt at 100 per cent. palletization in a cold store built for common user.

The principal contractors were Robinson & Sawdon Limited, builders of Hull, and two of the leaders in the cold storage industry, L. Sterne & Co. Ltd., who have been responsible for the refrigeration, and Smiths Insulations Limited, who were responsible for the structure of the store and its insulation. The architects were Messrs. Gelder & Kitchen of Hull.

The decision to construct the store was taken



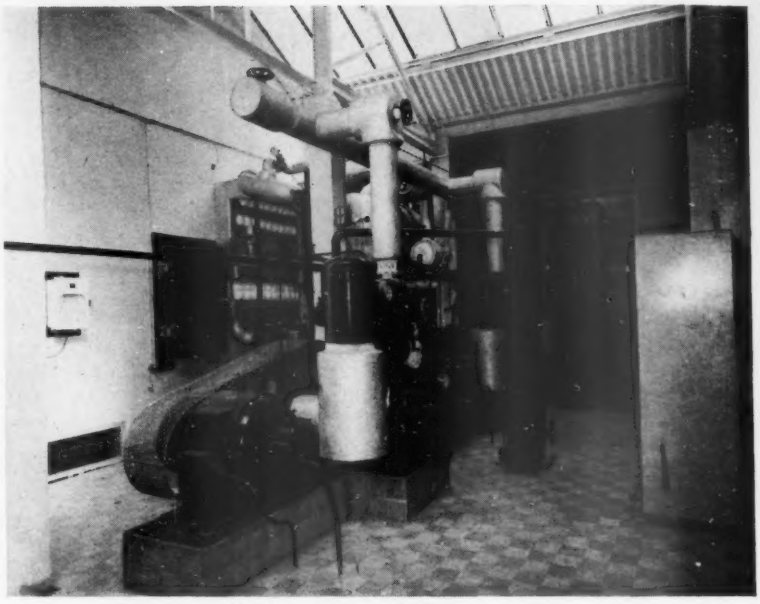
Right: This lorry-height bank gives direct access by fork lift truck, to store.

Below: One fork lift truck can work the two chambers.

and the contracts placed in May and June, 1957. The scheduled date for completion was March 1, 1958. The foundations were laid in August, 1957, and erection of the store commenced in October, 1957. The store was completed and in operation on February 27, 1958, so the programme worked out exactly to plan.

Access to the store is provided by a covered loading bay which accommodates four vehicles at one time, and behind the loading bay are offices, engine room and pallet storage. The loading dock is roofed and totally enclosed. Roller shutters protect the street entrance, and all loading and unloading are under cover.

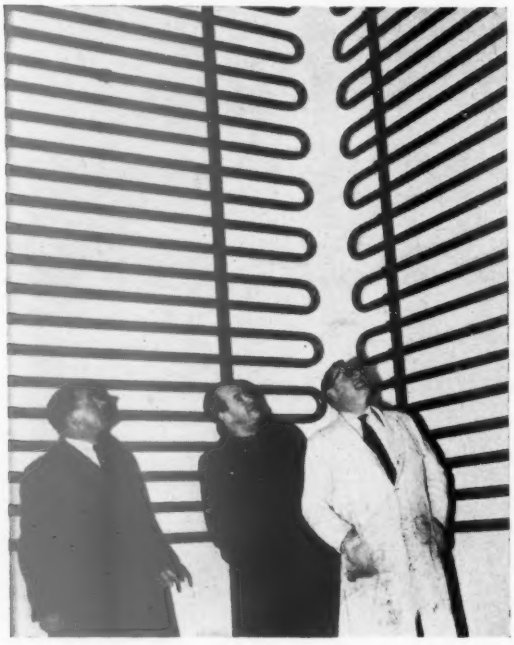
There are facilities for four vehicles at a time. The lorries back up to the loading platform, which is 4 ft. high at the end of the loading dock. It consists of Bison concrete beams carried on sleeper walls with a screed of granolithic cement. There is direct access at a constant level from the loading



Right: The refrigerating machine hall.

Below: Inspecting the recently completed chambers are: r. to l. Mr. Smith, of Smiths Insulations Ltd.; Mr. H. Davison, J. Marr and Son Ltd., and L. Sterne & Co. Ltd.'s representative.

platform to the store by means of a 10 ft. high super-freeze door. This is open during loading and unloading, and maintenance of temperature



in the store and prevention of moisture penetration is achieved by the provision of rubber buffer doors and a Miniveil air curtain.

Lorries are loaded and unloaded by means of roller conveyors down which the cases of frozen goods pass to the platform to be built up on wooden pallets in lots of approximately 20 to 25 cwt. The pallets are conveyed to the weigh scale by a Worksaver pallet truck and carried into the store and stacked by Conveyancer and Yale fork lift trucks. There are usually four pallets to the stack, each stack being 18 ft. high.

Common storage (that is storage of all classes of goods) poses problems when attempting to stack on a standard pallet, but these have been overcome. Fragile or insecure packages are specially protected by steel frames superimposed on the wooden pallets.

Special care is taken of personnel, who are equipped with suitable protective clothing. They also have a warm rest room for their use when not working in the store.

The total capacity of the store is approximately 2,000 tons, but there is room on the site for a further 1,000 to 1,500 tons capacity. Provision has been made in both layout of loading facilities and in the engine room for extensions as and when required.

The Building

The store consists of a building approximately 120 ft. × 80 ft. × 20 ft. divided into two rooms

by an insulated partition wall. These rooms can be maintained at different temperatures.

The store is steel framed, built with a clear span with no internal supporting beams or pillars. The floor is carried 4 ft. from ground level at the same height as the loading platform and consists of Bison precast concrete beams carried on brick sleeper walls. On this is laid 9 in. of cork insulation, vapour sealed throughout, and covered with a granolithic concrete floor. No electric mat is required as the risk of frost-heave has been obviated by the free passage of air under the floor.

The walls consist of 10 in. cork insulation borne on cedar frames, vapour sealed, and surrounded by air spaces, fire proof asbestos insulation boards, and an outer cladding of heavy gauge aluminium trough sheeting.

The prefabricated ceiling consists of 5 in. expanded polystyrene units with 4 in. cork insulation added, all vapour sealed, making 9 in. throughout. It is suspended from roof trusses and the outer roof cladding is of asbestos sheeting.

The building consists, therefore, of a huge suspended insulated chamber, vapour sealed, with an air space all round and an external skin of aluminium, asbestos or brick as the case may be.

Refrigeration

A constant temperature of –20° F. is maintained. Refrigeration is produced by the circulation of liquid ammonia delivered into ceiling and wall grids which consist of seven miles of 1½ in. bore piping in 28 circuits.

All the circuits are brought directly into the engine room which adjoins the store, and all valves are in the engine room and not in the store. Each circuit can be defrosted individually.

Refrigeration is maintained by three Sterne mark III MAC compressors each belt driven by a 60 h.p. electric motor. Three induced draught mark FDB30 condensers are situated on the loading bay roof. Two ammonia pumps are installed and the ammonia accumulator is a welded steel vessel 12 ft. 6 in. long × 30 in. diameter.

The capacity of the machinery is far in excess of requirements. Under winter weather conditions, and with an intake of 100 tons per day, only one compressor is required. The second compressor takes care of abnormal summer conditions or abnormal storage requirements, and the third compressor is a standby at the moment, but installed with a view to future extensions. Provision is also made for a fourth compressor and condenser when extensions to the store take place.

All the refrigeration is automatically controlled by a multi-motor automatic contactor type control panel actuated by room thermostats.

Protecting Ice Cream in Nairobi.—Hundreds of cartons of ice cream made in Britain are making their appearance in distant parts of East Africa—where the day temperature at this time of the year in Mombasa seldom falls below 91°. The secret is a new refrigerated container which can go anywhere. Its first destination is Kampala in Uganda. This is the first of a series of shipments by T. Wall & Sons (Ice Cream) Ltd., to establish the practicability of supplying their ice cream not only to Kampala but to many hot, up-country towns where good ice cream is not often tasted. In readiness for the arrival of the first refrigerated shipment of ice cream two specially designed mobile refrigerators were made ready at the quayside in Mombasa. Ten feet long, with built-in refrigeration units each holds 600 cartons of ice cream at sub-zero temperatures. Taken up-country by rail and road, they will help to keep East Africans cool until their contents have all been used. Then, during their return journey to the coast, they may help to solve another of East Africa's catering problems—by bringing back other food products to the coast.

C. and G. Institute's New Home.—When it occupies its new home, the City and Guilds of London Institute will leave the City of London and move into the Borough of St. Marylebone. It was, therefore, the Mayor of St. Marylebone, Councillor John E. Guest, who received His Royal Highness the Duke of Edinburgh when he arrived recently to lay the foundation stone of the new building and conducted him to Sir Frederick Handley Page, C.B.E., F.C.G.I., chairman of the council. In 1950 the Institute examined 74,000 candidates ; by 1957 that number had gone up to 120,000 candidates.

* * *

Cold Store Merger.—The proposed amalgamation of the Bon-Accord Ice and Cold Storage Co. and the North-Eastern Ice Co. Ltd., both of Aberdeen, is to take place. An amendment put forward by shareholders of the North-Eastern Company who thought the terms of amalgamation unfair and that the question of amalgamation be referred back to the directors appeared to be carried by a show of hands at a meeting last month. On a poll being taken based on the number of votes held, however, the amendment was defeated by a small majority.

Purchase Tax Reduction on Domestic Refrigerators

VIEWS FROM THE INDUSTRY

FOLLOWING the reduction of purchase tax on domestic refrigerators authorized by the Chancellor of the Exchequer in his budget, from 60 per cent. to 30 per cent., " M.R." has sought the views of trade leaders on this topic. A selection of replies is given hereunder :—

Duncan A. Welch, household sales manager, Kelvinator Ltd., states : " The Budget reduction of purchase tax is an important first step to stimulate a healthy home market in domestic refrigerators. During recent years the industry has been meeting increasing competition from European countries whose home market is encouraged. A healthy home market must ultimately result in reduced prices both at home and abroad and if this policy is continued by the authorities it will be of the greatest assistance to the industry in raising the standard of living of the British housewife and at the same time helping our export sales."

Mr. Stanley Broughton, managing director, Electrolux Ltd., states: " Our industry, through the Domestic Refrigeration Development Committee, of which Electrolux is a member, campaigned hard for a reduction in the penal 60 per cent. tax. Its imposition, and the consequent reduction of our home trade, has meant that British manufacturers have been engaged in an unequal struggle overseas with foreign firms. The impetus to home sales given by this timely and most appreciated reduction will undoubtedly reflect itself in a greater share of the overseas market for the domestic refrigeration industry."

Mr. A. W. Porter, director, Frigidaire Division of General Motors, states: " For a number of years now we have been operating in the domestic refrigeration field under the twin difficulties of a high purchase tax rate and hire purchase terms which have become increasingly restrictive. That one of these burdens has at least been eased is good news indeed. If, as we hope, this relief encourages increased sales in the home market it will not only have the effect of raising the living standards in this country but it will also help us as manufacturers to be more competitive overseas. To take full advantage of the Chancellor's proposal, however, we must further expand our pro-

" . . . or, in plain English, Sir, the Chancellor puts your belly before your telly ! "

Specially drawn for " M.R."

duction facilities. We will do so in the hope that the present tax reduction is a progressive step aimed at establishing stable conditions. Given this stability the industry can fully demonstrate its appreciation by increasing its already good export performance."

Mr. E. G. Rowledge, general manager and director, Prestcold Refrigeration Division, Pressed Steel Co. Ltd., states: "The Chancellor's recognition of the refrigerator as a household necessity, and not a luxury, is most welcome. The public will benefit, as many more people will now be able to enjoy the advantages of refrigeration. In itself, this will be to the advantage of manufacturers and, more important, they will be better able to meet competition in overseas markets as a result of larger scale, and therefore more economic, production. The retail trade will be able to stock and promote the sale of refrigerators in the confident knowledge that with the removal of the previous penal rate of tax, an immediate and extremely large-scale demand will certainly result. Summarized, the cut in purchase tax will bring a worth-while amenity within the range of many people previously denied it and will enable both manufacturers and those engaged in marketing to plan ahead on a more stable basis than has hitherto been possible."

Mr. C. R. Purley, chairman and joint managing director, Lec Refrigeration Ltd., states: "I personally do not understand the Government reducing the purchase tax on domestic refrigerators at this particular time as I believe the industry is generally very busy and the reduction is bound to divert concentration on the export market back to the home market. Of course, it is a very good thing if it allows more British people to acquire an essential for the home which otherwise they would not be able to afford."

Mr. A. R. M. Tanner, Easiclene Porcelain-Enamel (1938) Ltd., states: "The reduction in purchase tax on refrigerators is satisfactory, but it is unfortunate that so little notice has been given at the beginning of the season. Sales will improve, but extra production at such short notice is impossible. The Government's 'see-saw' policy frustrates any attempt to maintain level and economic production."

Mr. R. A. R. Fanshawe, sales manager, R. & A. Main Ltd., states: "The reduction in purchase tax is welcome news and a step in the right direction. Here's hoping that it will come down lower still and, above all, that hire purchase restrictions will soon be eased. Onward to the day when a refrigerator will be found in every home and away with the word 'luxury' as applied to this essential piece of equipment."

Mr. H. C. Timewell, general manager, appliance division, English Electric Co. Ltd., states: "Last month's budget announcing a reduction in purchase tax to 30 per cent. may come to be regarded as a milestone in the development of Britain's domestic refrigerator industry. Looking back to the years of 1945 and 1946 when there was no purchase tax, it is remarkable that the industry has retained any measure of equilibrium on the see-saw of changes it has faced. In the Budget of 1947 a tax of 66⅔ discount was inflicted, which was amended in June of that year to nil, but this happy state of affairs only prevailed until 1948 when tax once more was imposed at 33⅓ per cent., changed to 66⅔ per cent. in 1951, reduced to 50 per cent. in 1953, increased to 60 per cent. in 1957, and now reduced to 30 per cent. Although the refrigerator still appears to be one of the whipping posts for the country's financial experts, it is very encouraging that the present Chancellor had seen fit to cut the tax in half, and generally to rationalize the whole hire purchase procedure. The effect on sales has been immediate. Undoubtedly, the action has been accepted as a spur to manufacturers to greater effort in overseas markets, and the consequent rise in production will enable all of us to compete better in these export markets.

* * *

Some New Prices Based on Reduced Tax

FRIGIDAIRE

RETAIL price reductions ranging from 8 to 26 guineas per cabinet are announced by the Frigidaire Division of General Motors Ltd., following the Chancellor of the Exchequer's decision to lower the purchase tax rates on household refrigerators.

New prices, with reductions shown in parenthesis, are as follows :—

Model		Gross capacity c. ft.	New price guineas	Reduction guineas
MY-32A	(built-in)	3·2	56	(8)
MY-32T	(master)	3·2	57	(8)
MY-45A	(built-in)	4·5	65	(10)
MY-45T	(master)	4·5	67	(10)
DY-45A	(built-in)	4·5	72	(10)
DY-45T	(de luxe)	4·5	74	(10)
MY-94	(master)	9·4	125	(17)
MY-111	(master)	11·1	155	(24)

DY–94	(de luxe)	9·4	138	(20)
DY–111	(de luxe)	11·1	169	(26)

A retail price reduction of 5 guineas is also effective immediately on the Frigidaire " Cascade " spin drier, the old price of 34 guineas being reduced to 29 guineas.

Through increased production and manufacturing efficiency consequent on an increasing public acceptance of the refrigerator as a necessity rather than a luxury, prices of refrigerators have been reduced steadily over the last few years. The new prices are in fact the lowest since the war. A comparison with prices existing in 1953 for example shows that, whereas a 4½ c.ft. capacity Frigidaire cabinet is now priced at 77 guineas, a similar sized model was in that year retailing at £99 19s.

PRESTCOLD

In view of the recent budget reductions in purchase tax, the prices of current Prestcold domestic models are now :—

Model			£	s.	d.
D.301	Packaway	List price	49	8	10
		Purchase tax	10	8	2
		Total	59	17	0
DW.301	Packaway (wall-mounting model)	List price	49	8	10
		Purchase tax	10	8	2
		Total	59	17	0
Wall-mounting pack for DW.301		List price	2	3	1
		Purchase tax		9	5
		Total	2	12	6
D.431	Big Four	List price	56	6	7
		Purchase tax	11	18	5
		Total	68	5	0
D.601	Superb Six	List price	83	4	1
		Purchase tax	17	11	11
		Total	100	16	0
T.901	Automatic Nine	List price	119	11	0
		Purchase tax	25	7	0
		Total	144	18	0
HF.51	Home Freezer	List price	106	4	8
		Purchase tax	21	15	4
		Total	128	0	0
HF.101	Home Freezer	List price	141	17	1
		Purchase tax	29	2	11
		Total	171	0	0

ENGLISH ELECTRIC

Following the reduction in the rate of purchase tax announced in the Budget statement, the price of English Electric domestic refrigerators is now:—

Model	*Total price*			*Purchase tax*		
	£	s.	d.	£	s.	d.
7501	108	10	6	19	10	6
7502	122	13	5	22	1	5
7503	58	14	8	10	11	5

B.R.A.'s Annual Get-Together

THE annual luncheon of The British Refrigeration Association, held in the Connaught Rooms, London, reflected the upsurge of the industry and was a well-attended, vital function. Guest of honour was Lord Mills, K.B.E., Minister of Power. Mr. D. S. Carruthers, chairman of the Association, presided, and he was supported by, on the " top table," the following :—

Mr. A. S. Alexander, president, National Association of Quick Frozen Food Processors ; Mr. J. Baillie, general secretary, Ice Cream Alliance ; Mr. Roy Baldwin, managing director, Electrical Times Ltd. ; Mr. J. I. Bernard, director and secretary, British Electrical Development Association ; Mr. A. W. Berry, director, British Engineers' Association ; Mr. H. A. R. Binney, C.B., director, British Standards Institution ; Mr. E. A. Bromfield, general secretary, Association of Supervising Electrical Engineers ; Mr. D. Maxwell Buist, export director, British Electrical & Allied Manufacturers' Association ; Mr. L. F. Cadwallader, O.B.E., director, National Association of Master Bakers, Confectioners & Caterers ; The Rt. Hon. Lord Citrine, P.C., K.B.E., The Electricity Council ; Mr. R. W. H. Covell, president, National Federation of Meat Traders' Associations ; Mr. W. R. Cox, president, The Institution of Heating & Ventilating Engineers ; Mr. Eric Davies, legal adviser ; Mr. R. I. Drake, member of council ; Mr. W. B. Draper, chairman, Food Machinery Association ; Mr. P. B. Etheridge, director & secretary, Electrical Wholesalers' Federation ; Dr. J. E. Garside, director, National College for Heating, Ventilating, Refrigeration & Fan Engineering ; Miss Mary George, M.B.E., director, Electrical Association for Women ; Dr. Ezer Griffiths, O.B.E., president, International Institute of Refrigeration ; Mr. R. H. Hemmings, member of council ; Dr. E. H. T. Hoblyn, M.B.E., director, Food Machinery Association ; Mr. Barrington Hooper, C.B.E., president, The National Federation of Fishmongers, Poultry, Game & Rabbit Traders Ltd. ; Mr. J. A. Howie, member of council ; Mr. D. B. Irving, chairman, London Electricity Board ; Mr. J. R. T. Gibson Jarvie, deputy chairman, United Dominions Trust Ltd. ; Prof. H. D. Kay, C.B.E., director, National Institute for Research in Dairying ; Viscountess Kilmuir, president, Electrical Associa-

Key to Photographic Groups opposite: 1. Sir Henry Self, K.C.B., K.C.M.G., K.B.E., J. A. Howie and W. R. Cox; 2. (*Starting fourth from left*) **Lord Mills, Mr. D. S. Carruthers, Lord Citrine, P.C., K.B.E., and Ald. W. J. Ridd, J.P.; 3. Mr. T. Whittaker, Dr. E. Griffiths, O.B.E., F.R.S., and Mr. D. S. Carruthers; 4. Mr. G. E. Worssam, Mr. C. M. Marks, Mr. N. F. Saunders and Mr. K. J. R. Cocke; 5. Mr. D. A. Welch, Mr. F. L. Pettmann and Mr. R. H. Hemmings; 6. Mr. J. N. Lampson, Mr. S. G. Armitage and Mr. L. H. Kennett; 7. Mr. J. T. Herbert, Mr. E. Le Fre, Mr. B. Fowler and Mr. H. R. Chuter; 8. Mr. D. J. Ward, Mr. R. S. Hunt, Mr. D. E. Hall and Mr. F. M. Braithwaite; 9. Mr. J. R. T. Gibson Jarvie and Mr. A. A. Shenfield; 10. Mr. G. E. Taylor, Mr. P. K. Mackenzie and Mr. J. Douglas; 11. Mr. J. Stuart Bennett, Mr. F. Fields, Mr. R. J. McGuffog, Mr. C. S. Griffin, Mr. A. J. Wake and Mr. E. V. Symonds; 12. Mr. K. H. Vere, Mr. E. L. Norris, Mr. R. S. Palmer, Mr. J. S. Wilson, Mr. I. G. Mence, Mr. T. L. Pritchard, Mr. K. E. R. Butler and Mr. S. E. Luxford.**

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tion for Women ; Mr. E. C. H. Leather, Member of Parliament ; Mr. D. T. Lee, secretary, Institute of Refrigeration ; Mr. B. H. Leeson, C.B.E., director, British Electrical & Allied Manufacturers' Association ; Mr. W. S. Lewis, C.B.E., J.P., chairman, British Electrical Development Association ; Mr. Kenneth Lightfoot, O.B.E chairman, Lightfoot Refrigeration Co. Ltd. ; Mr. Peter K. Mackenzie, secretary, Dairy Engineers' Association ; Mr. E. D. McMillan, Price Waterhouse & Co. ; Mr. C. M. Marks, member of council ; Mr. W. Mitchell, secretary, National Association of Quick Frozen Food Processors ; Mr. A. Nicol, member of council ; Mr. A. W. Palmer, Member of Parliament ; Mr. L. C. Penwill, C.B.E., director & secretary, Electrical Conreactors' Association ; Mr. H. S. Pocock, managing director, Electrical Review Publications Ltd. ; Mr. J. S. Price, Price Waterhouse & Co. ; Mr. N. O. Quibell, chairman, National Association of Wholesale Distributors of Frozen Food ; Mr. S. B. Redfern, president, National Association of Master Bakers, Confectioners & Caterers ; Mr. R. Reid-Adam, C.B.E., Board of Trade ; Alderman W. J. Ridd, J.P., Mayor of Holborn ; Mr. H. Riley, president, Electrical Wholesalers' Federation ; Mr. Felix Rogers, M.B.E., British Electrical & Allied Manufacturers' Association ; Mr. Charles Royle, Member of Parliament ; Mr. R. Y. Sanders, deputy commercial & development adviser, The Electricity Council ; Mr. N. F. T. Saunders, member of council ; Sir Henry Self, K.C.B., K.C.M.G., K.B.E., chairman, The Electricity Council ; Mr. A. A. Shenfield, economic adviser, Federation of British Industries ; Mr. J. W. Simpson, O.B.E., secretary, British Electrical Power Convention ; Mr. J. Smellie, general secretary, The Electrical Contractors Association of Scotland ; Mr. A. W. P. Stephen, member of council ; Mr. G. E. Taylor, chairman, Dairy Engineers' Association ; Sir Edward Thompson, J.P., president, British Engineers' Association ; Mr. D. L. Walker, C.B.E., general secretary, Federation of British Industries ; Mr. D. A. Welch, member of council ; Mr. T. Whittaker, director of the Association ; and Mr. G. E. Worssam, member of council.

Lord Mills proposed the toast of " The British Refrigeration Association," saying that the products of the industry had become symbols of civilized living. Since the end of the last century, the industry had covered the world with refrigerated shipping and refrigerated trains, to form a complete " cold chain," and had thereby opened up the southern hemisphere. In passing, the speaker referred to the interesting experiment, in which his department was concerned of shipping methane gas in liquid form from America to Great Britain ; refrigeration, of course, was needed for this operation.

He complimented the industry on having built up such a successful export trade and assured them that he had taken note of their purchase tax problems.

After having thanked his lordship for his complimentary remarks, Mr. Carruthers said, in part : " I do not need to tell you how completely dependent our customers are on the essential services for which you are responsible.

" People who live in the great cities know very little about power cuts, but in the country districts where some of us live, fed by overhead wires, cuts can last all day. Then, truly, it is panic stations to get dry ice for the deep freezer, not to mention hand feeding stock and hand milking the cows—by candle light. I am thoroughly ashamed of myself starting off by airing these petty complaints although I assure you I was just illustrating from humble experience how completely the industry for which I speak is in your power. We know, of course, that yours is a beneficent and friendly power, striving to help us in all possible ways with our developments : which, of course, on the other hand is all very right and proper as you have the consolation and satisfaction of the quarterly account.

" I think I should tell you right away that part of this industry has been feeling frustrated for some years now. I mention this just in case you have not heard it being shouted from the house tops. I refer particularly to the domestic refrigerator, and to a certain extent the small commercial sections. Both suffer from grievous restrictions to credit dealings and the former carries also the almost intolerable burden of a 60 per cent purchase tax. Year after year we have struggled on carrying these deadly burdens and not quite fully understanding why. If we were selling something which was purely decorative or even entertaining, or amusing, we would understand but instead we are making a product which represents the biggest step forward in food hygiene and preservation in our generation, or any other generation. I would refer in passing especially to one small section of our industry which has been practically exterminated by these taxes. These ingenious people used a refrigeration system having the condensers in the domestic hot-water cylinders and the evaporators cooling the larder. This gives hot water for one-third of the electricity required for an immerser *and* refrigeration to boot, but bang went on the 60 per cent. purchase tax, and down on its knees went this new power-saving industry when it was just learning to toddle.

" As a nation we gave everything to win the war and save the world from oppression ; yet we find that most of Europe is refrigeration happy compared with us. Every week four European housewives to one British housewife per head of the population gets a new refrigerator. As regards home freezers the position is much more marked; the British housewife has practically no chance while European housewives are buying them quite freely : but then only Britain has purchase tax.

" I believe, gentlemen, that this country stands at the cross-roads ; we must choose between continuing restrictions and controls or taking the bolder course of risking our future prosperity on production and more production. I am absolutely convinced that the correct answer is production. Let us go flat out until production schedules that are a dream to-day become a reality to-morrow ; and the day after we scrap our schedules for larger ones.

" I know an assembly line which was designed three years ago for 200 units per day. The workers claimed they could do only 160 but after six months agreed to 200. To-day, with very few extra bodies, that production line is doing 700 per day, the pay packets have increased 64 per cent. without overtime, and the product cost has come down by 17½ per cent. That is an example of what I mean. Why should a working man have to slave all sorts of overtime to buy equipment for his home and perhaps a small car. Far better make it interesting for him to give productivity such as he has never known before and go home at the week-end to his wife and family. Let both the management and the workers get on to the bandwagon of productivity.

" The Government must take the lead and start reducing these crippling purchase taxes and bring a slight thaw to the credit freeze.

" I cannot speak with authority for other industries but I do know what would happen in the refrigeration industry. The great refrigerator factories now idling along would receive an injection. Production would gather momentum, restrictive practices would be forgotten in the new security, costs would come tumbling down until new markets abroad just could not afford to refuse our goods. I know this is true, gentlemen, because I have proved it in my own factory, making machines only.

" I am happy to say, as many of you know, that the industrial and commercial branches of our industry have again increased their contribution to the national wealth.

" Commercial refrigeration has increased by fully £1,000,000 and while this is mainly on the home market the export figure has been substantially increased. I think it is true to say that the main factor contributing to this increase has been the spread of enlightenment among the general public on the use and enjoyment of frozen foods.

" This has been coupled with more aggressive selling on the part of the retail stores involving them in more display and particularly more refrigerated display. All this is good for the national health as well as the national wealth.

" Industrial refrigeration, while a smaller branch, of the industry financially has shown a sharp increase of £400,000 to £4,680,000. Here again export has increased.

" The overall production of the industry, while nowhere near capacity, particularly as regards domestic refrigeration, has nevertheless made a satisfactory showing. The total production increased in 1957 by £3,500,000 to £34,000,000,

of which £13,000,000 was export. This figure does not include marine refrigeration and some other branches which would bring the total up to around £40,000,000.

"But here—I would strike a note of warning: in 1957 the industry exported just on 40 per cent. and that is too heavy a burden to carry indefinitely. Do not mistake me, I am proud of my industry in achieving such figures, particularly as our hard currency exports are increasing more rapidly than the general exports. It is a wonderful contribution to the national economy. I am doubtful, however, if we can continue doing this. We can beat the total export certainly; in fact, I hope we can double and redouble it as European free trade starts to work, but the 40 per cent. is, at present, a terrible burden. How many other industries in this country can equal it. I throw out the challenge that there are *dam*' few. All this export business is taken in the face of powerful and growing competition. Selling prices in various countries have to be competitive with the prices ruling in that country, otherwise—no business. The sad result, however, is that the profits of the industry are too low.

"Gentlemen, I speak here for the domestic and commercial sections of the industry which constitute 80 per cent. of the whole. The inevitable result of the low profits is that too little is spent on new plant. Renewals are too tardy and not enough is spent on improved-design machinery. I believe to a certain extent that is happening in the refrigeration industry.

"Lord Mills, you are a responsible Minister of the Government and I trust you will not think me discourteous as a host if I repeat in your presence my appeal to the Government for a more positive approach to the problems of this and other industries. We pray for encouragement, not inhibitions. Encouragement to plan for the extraordinary productivity which I am certain the workers and the factories of the country can give.

"You have paid great tribute to our industry to-day and believe me we are grateful. We are greatly honoured that you have taken time off from your busy life to join us, and sincerely hope that, although our business is cold, you will carry away warm memories of the refrigeration industry."

New Ice Cream Factory.—Plans for a fourth ice cream factory, to be built at Gloucester, are announced by T. Wall & Sons (Ice Cream) Ltd. It is hoped that the necessary permits will be obtained in time to enable construction to begin this autumn, in which event the factory will be in production in 1960. Mr. J. D. O. Knowles, chairman, said the factory had been made necessary by increased sales of ice cream which were fast outstripping the production capacity of existing factories in London, Manchester and Edinburgh. The new factory, with an initial manufacturing capacity of about 10,000,000 gal. of ice cream and fruit ices each year, is expected to employ at least 400 people. Adjoining the factory will be a large cold store capable of holding about 750,000 gal. of ice cream. "Various sites were examined in consultation with the Board of Trade before Gloucester was chosen," said Mr. Knowles. Proposal to build the factory is, at present, being considered by the Gloucester City Council. The factory will be equipped with plant developed by Wall's own research staff and will incorporate an elaborate welfare block. The plant will supply ice cream to Wall's local distribution depots in the south-west of England, in South Wales and in parts of the Midlands. It will thus relieve pressure upon the London and Manchester factories.

A Freezer-Equipped Bakery

Garners' new premises at Greenford

THE latest example of the highly successful application of refrigeration to bakery foods is to be found at Greenford in Middlesex, where Sevenex Bakeries Ltd., operated by Garners (7x) Ltd., have greatly expanded their premises in Oldfield Lane.

By providing a low temperature storage chamber Garners have now eliminated many problems facing bakeries not so equipped and have been able to dispense with all night baking of confectionery. All fermented goods now pass through the freezer and are brought out in the early hours of the morning by two packers who arrange the products ready for loading on to the large fleet of lorries which serve the sixteen retail shops situated in the area between Greenford and Watford.

The foods which fall within the category mentioned and which are suitable for "sub-zero" holding include the following: Scotch farle, scones, bridge rolls, plain buns, baps, Bath buns, tea cakes, cookies, Swiss buns, doughnuts, Danish buns, currant bread, milk bread, bun rings, Danish pastry and iced doughnut rings.

This refrigeration installation by J. & E. Hall Ltd. comprises a low temperature deep freeze chamber which is built against four brick walls and provided with an independent ceiling carried on two rolled steel joists. The walls and ceiling of the room are insulated throughout with 8 in. of best quality compressed cork board, the floor being insulated with the same material 6 in. thick. The capacity of the room is approximately 4,000

This freezer is entered through the door seen on the opposite page, protected by a Miniveil. Adjacent is the engine room, a larger view of which is below, right.

c.ft. and measures internally 29 ft. 6 in. by 17 ft. by 8 ft. high. All insulation is applied in two layers with all joints staggered and set in special bituminous solution and special care has been exercised to provide a perfect vapour seal on the outside of all insulated surfaces.

The floor, which is covered on top with granolithic cement, has been arranged to coincide with the level of the bakery floor to facilitate the wheeling of trolleys in and out of the cold chamber. This necessitated the excavating of the site floor to a predetermined depth to allow for the insulation and granolithic together with an electric heater mat laid on the base of the excavation before applying the cork. The heater mat has been installed to prevent freezing of moisture in the sub-soil and its temperature is controlled automatically at 34° to 36° F. by a special electronic controller incorporating a temperature indicator.

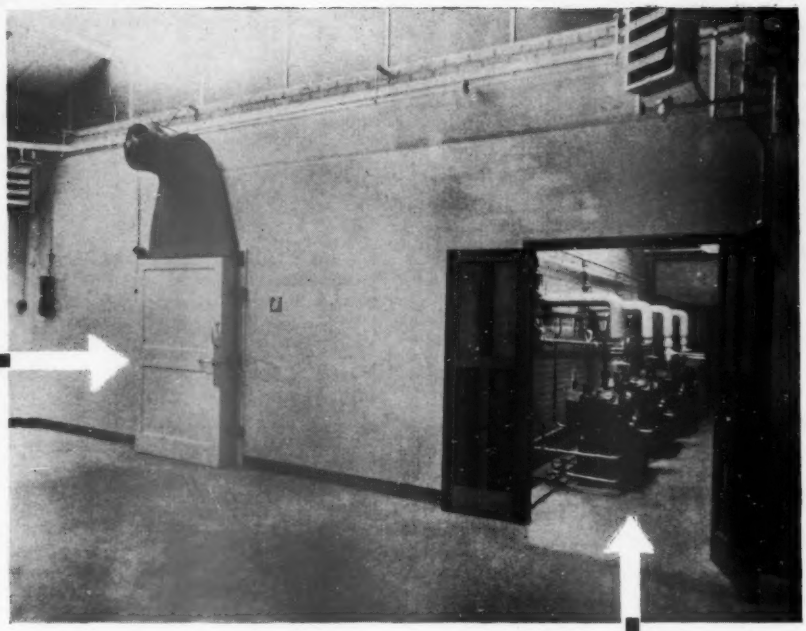
The chamber walls and ceiling are finished on the inside with Portland cement and sand, scored into 3 ft. squares painted in cream Vitrotex paint, and the top side of the ceiling is boarded with ¾ in. matching unpainted.

One door provides access to the cold chamber, being of the superfreezer face fitting type having a clear opening of 3 ft. 6 in. wide by 6 ft. 6 in. high. The door is insulated with 6 in. of Onazote faced on the inside with polished Birmabright and the outside panelled in timber. The door jambs are also covered with Birmabright and a Birmabright finger plate is fitted on the outside of the door.

The door frame incorporates an electric heater gasket maintained at a constant temperature by a simmerstat and the door is fitted with heavy type galvanized hinges and fastener. The whole of the exposed external woodwork of the frame is painted with cream paint to match glazed tiles on the external face of the wall containing the door. Above the door is fitted a Miniveil air duct so that when the door is opened a stream of high velocity air is forced down over the door opening thus preventing an inter-change of air between the outside and inside.

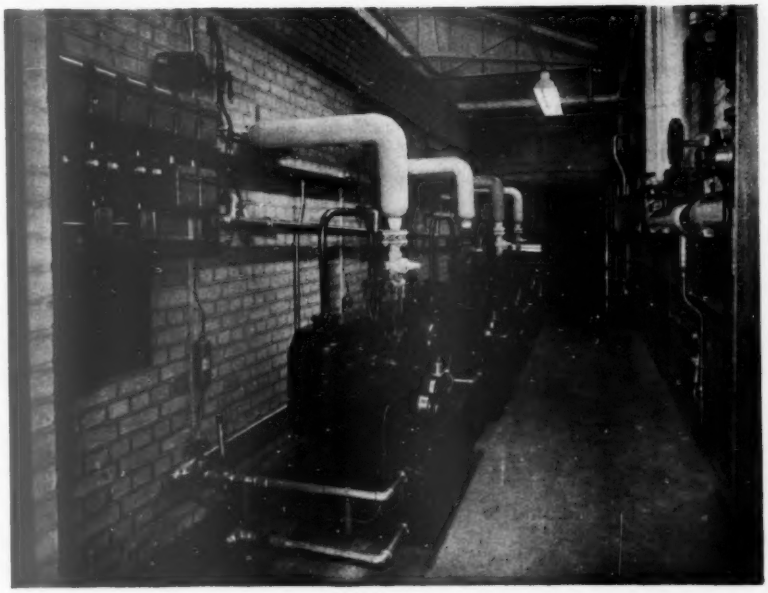
The room is operated by four forced-draught air blast unit coolers each equipped with water defrost assemblies and two powerful propeller type fans. These coolers are each connected to a Hallmark 5 h.p. model 6CPM compressor unit having multi-pass water cool condensers. The condenser cooling water is continuously circulated and is cooled by an induced draught cooling tower mounted in the roof space above the cold chamber with air discharge to atmosphere. The water is circulated by ¾ h.p. direct coupled centrifugal pump and thermometers are fitted in the water piping to indicate the inlet and outlet temperature of the water from the condensers.

The compressor units and pump are located in an engine built along one side of the cold



chamber and all electrical control equipment is situated adjacent. The compressors are thermostatically controlled and are designed to maintain the chamber temperature at 0° to 5° F. and to freeze 550 lb. of bakery products per hour from 85° F.

A time delay relay is fitted in the electrical circuit of each compressor motor to prevent more than one motor starting at the same time, and the controls are arranged so that one, or more, compressor can be in use as desired. The compressors are of the very latest design being of the inclined 6-cylinder type incorporating an oil pump driven from the end of the crank shaft for circulating oil to all moving parts.



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The Institute of Refrigeration Bulletin

Institute Headquarters: New Bridge Street House, New Bridge St., London, E.C.4 (CENtral 4694)

THE EXECUTIVE COUNCIL

The members of the executive council of the Institute for the year March 26, 1958, to March 25, 1959, are :—

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Sir Rupert De la Bère, BT., K.C.V.O.

Past-Presidents

Lieutenant-Colonel Lord Dudley Gordon, D.S.O., LL.D.
Sir Charles G. Darwin, K.B.E., M.C., SC.D., F.R.S.
The Right Hon. Viscount Bruce of Melbourne, P.C., C.H., M.C., F.R.S.

Vice-Presidents

Stanley Fabes Dorey, C.B.E., D.SC., F.R.S., WH.EX.
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Edward Frederick Farrow.
Kenneth Lightfoot, O.B.E.

Elected Members of Council

Henry Randal Steward, T.D., B.SC.(ENG.). (Chairman).
Charles Maurice Brain.
James Arnold Brewster.
Kenneth John Rallings Cocke, B.SC. (ENG.).
James Douglas, B.SC. (ENG.).
John Carter Fidler, O.B.E., B.SC., PH.D.
Kenneth Calvert Hales, M.A.
Elliott Morley Heap, M.ENG.
Herbert Reid Howells.
Reginald Henry Redvers Lloyd.
Godfrey Yate Pitts, M.ENG.
Walter Robert Sinclair, B.ENG.
James Charles Taylor.
Stuart Browning Turner.

PADUA INTERNATIONAL FAIR

Cold Storage Conference

The Executive Committee of the Padua International Fair announces that, in co-operation with the Italian Cold Storage Association, the Centre of Studies for the Applications of Refrigeration of the National Council of Research at the Padua University, the Milan Cold Storage Experimental Station, and the Cold Storage Machinery Manufacturers' Union, the 7th National Cold Storage Conference will be held in Padua on June 1, 2 and 3.

It is understood that the subjects to be discussed at the conference will be :—

1. PRE-COOLING (Convener : Eng. Dr. A. GIAMBELLI).
2. REFRIGERATED TRANSPORT
   (*a*) " on rail " (Convener : Eng. Dr. A. CUTTICA).
   (*b*) " by truck " (Convener : Eng. Dr. U. V. BERNIERI).
3. TRENDS AND DEVELOPMENT OF FRUIT AND VEGETABLE REFRIGERATION EQUIPMENT IN ITALY (Convener : Dr. V. CREA).

Further details of the conference may be obtained from the Secretary of the Institute.

Summer School on the Principles and Practice of Non-Destructive Testing

A summer school on the principles and practice of non-destructive testing, intended to benefit senior and chief inspectors from industry, is to be held at the Manchester College of Science and Technology from September 8 to 12, 1958. This summer school has been sponsored by the British National Committee for Non-Destructive Testing, and is being organized by the Manchester College of Science and Technology, the Manchester Association of Engineers, and the Institution of Engineering Inspection.

Those attending the course are expected to have some basic knowledge of non-destructive testing techniques. The physical background of the subject and the interpretation of test results will be the dominant themes of the course. The total cost of the course is expected to be approximately £18. Accommodation for those attending will be provided in the residential quarters of Hulme Hall. For further details, please apply to the organizing lecturer, Dr. J. H. Lamble, PH.D., D.SC., M.ENG., M.I.MECH.E., Manchester College of Science and Technology, Manchester, 1.

MIXED REFRIGERANTS FOR NON-ISOTHERMAL REFRIGERATION

"A NUMBER of scientists and engineers have described the theoretical virtues of mixed refrigerants. A few have tried to test their predictions by experiment but the resulting story has in general been a sorry one, and has given little encouragement to others to enter the field," declared Messrs G. G. Haselden, B.SC., PH.D., and L. Klimek, DIPL. ING., PH.D., in a paper before the Institute of Refrigeration last month.

"Pictet in 1888 proposed using a mixture of carbon dioxide and sulphur dioxide in a vapour compression machine claiming that by so doing he would reduce the size of the compressor and the compression ratio as compared to a machine using pure SO_2. He was unable to realize these claims in practice and was also accused at the time of violating the second Law. In 1933 Stradelli examined the use of SO_2/CO_2 mixtures more critically and predicted an increase of the compression ratio as CO_2 is added to pure SO_2 for the same operating temperatures. Despite this warning recent patent claims raise false hopes for the use of mixed refrigerants for duties in which refrigeration is required at constant temperature, by ignoring the requirements of the Phase Rule.

"Maiuri appears to have been the first to appreciate that the main advantage arising from the use of mixtures (apart from those which form azeotropes) is their ability to evaporate through a range of temperature, thus giving a definite cooling range which could be profitably matched to certain types of refrigeration duty. This he appears to have tested only once, and at low temperatures, in a plant erected in Dagenham Docks, in which an ethylene/methane mixture, condensed in cascade with an ammonia absorption diffusion machine, was intended to provide cooling over a continuous refrigeration range down to −130° C. The plant was apparently unsuccessful.

"An ingenious adaptation of the mixed refrigerant process was described by Ruhemann in 1947 in which the temperature ranges of condensation and evaporation were exploited by dividing each into two stages to give a far lower refrigeration temperature (−90° C. was claimed) with a single-stage compressor than would be possible with a pure refrigerant. Again, however, the practical results were discouraging.

"The first comprehensive discussion of the use of mixed refrigerants in a simple vapour compression cycle for cooling over a temperature range was given by Carr. He made calculations for the duty of cooling a process stream from +55 to −30° F., and for this he proposed a refrigerant mixture of three components. He compared the mixed refrigerant process with a single-stage ammonia machine for the same operating conditions, and the same values of the logarithmic mean temperature difference in the condenser and evaporator, and showed that a power saving of 30 per cent. should be possible ; though it was not tested experimentally. This topic was also discussed by one of the present authors in a paper to this Institute in 1953, in which it was shown that power savings up to 50 per cent. are theoretically attainable for certain duties.

"From previous work it may, therefore, be concluded that theoretically considerable power savings should be possible if mixed refrigerants are used in place of pure refrigerants for cooling a flowing process material through a range of temperature, but that no experimental verification of this prediction has been made. This paper reports a partially successful experimental attack on the problem together with a more thorough theoretical assessment of the project which this investigation has made possible.

"The power saving claimed for mixed refrigerants for the type of duty described can also be partially achieved by multi-stage operation with a pure refrigerant. This factor must be taken into account in assessing the merits of the mixed refrigerant process."

The authors then embarked on a discussion of the phase behaviour of mixtures and its relationship to the mixed refrigerant process and a graphical representation of mixture properties. Then followed a description of their experimental work.

"While the experimental results obtained with mixed refrigerants do not show very significant power savings they show that the method is basically sound and indicate ways in which much larger savings could be confidently expected. It is, therefore, appropriate to reassess the advantages of mixed refrigerants by considering their applications to a specific example. The example chosen, which is particularly favourable to the use of mixed refrigerants, is the chilling of 10 tons per hr. of water from 70° to 45° F. with the rejection of heat to cooling water or air which rises in temperature from 70° F. to 95° F. Calculations were first made for conventional cycles using "Freon-12" and ammonia. Single-stage adiabatic compression with an efficiency of 80 per cent., and a minimum temperature approach of 5° F. in the condensers and evaporators was assumed," said the authors.

KITCHEN PLANNING

Completely revised editions, with new illustrations, of two EDA publications are now available. They are "Electric Kitchen Planning" (EDA 1715/RV) and "Cooking the Electric Way" (EDA 296E/RV). The 32-page illustrated brochure on electric kitchen planning, contains a wealth of information and guidance not only on the design of kitchens in new houses and flats, but also on the improvements of existing kitchens either as a whole, or in instalments. The brochure, which is intended for distribution to architects, builders and those buying a new house or having one built, contains sections on order in the kitchen, problem of the large kitchen, dining-kitchen plans, the minimum kitchen, food storage, refrigerators, food preparation space, ventilation, washing up, hot-water supply, home laundry, and kitchen lighting including the use of fluorescent lamps. As is pointed out in the introduction, the correct arrangement of the appliances and cupboards in a kitchen is not a matter of individual preference, but is based on the outcome of many practical tests and experiments made with differently arranged kitchens, to discover the most efficient and labour-saving layout.

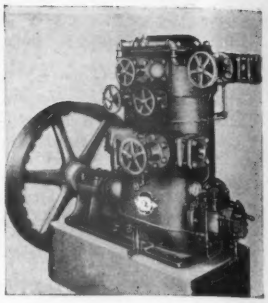
Fishing Boat Congress.—The Second World Fishing Boat Congress will be held in Rome in 1959. Various aspects of icing and mechanical refrigeration of holds will be discussed at this convention under the following headings : Handling of fish ; insulation, sheeting, painting and general arrangement of holds ; icing, sea-water cooling and freezing of fish.

* * *

The Gas Council are working with the Society of British Gas Industries on a "seal of approval" scheme for items of home gas equipment which appear in the Council's "list of tested and approved domestic gas appliances." Further details are to be announced.

COMMERCIAL AND INDUSTRIAL SECTION

Manufacturers' and distributors' news

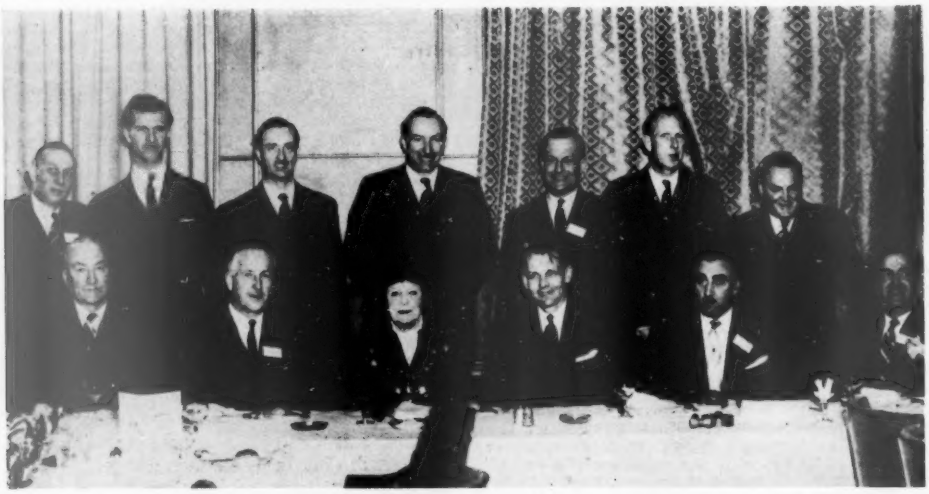


During the last three months, **Prestcold Refrigeration** have organized a number of very successful regional commercial sales meetings, at which their home market distributors' complete sales force have met Prestcold executives and discussed the national, regional and even their local sales policies, new models and many other factors of common interest. These meetings have enabled individual salesmen to discuss their various problems, and have proved to be extremely beneficial to everybody. There have been seven of these in all, the first five of which were held at Cowley, Oxford, the home of Prestcold. The last two, however, were held further afield, and are of particular interest in that one was held at a seaside resort and the other in Scotland. The first of these was held at Morecambe, Lancs, and here the conference was honoured with the presence of the mayor, Coun. Mrs. S. L. Birkett, J.P., at luncheon. Naturally the meal consisted mainly of frozen foods, a subject which was one of the items on the business agenda. Afterwards the mayor was presented with a cream cake which, although it had been made several weeks previously, was still as fresh as the day it was made, having been stored in a Prestcold deep-freeze refrigerator. The Scottish conference was held for the first time at Pressed Steel Company's Linwood, Paisley factory, and great interest was taken by the assembled refrigeration experts in other Pressed Steel products such as railway rolling stock, produced in this ultra-modern factory, which has the largest press shop in Scotland.

Mr. J. A. Hunter of L. Messel & Co. has joined the board of **Ranco Ltd.**, co-operating with Mr. Norman Best, director and general manager, and Mr. L. G. Hawkins, one of his co-directors.

* * *

For the last 35 years **Frigidaire Division of General Motors Ltd.**, London, has been concerned exclusively with the supply and manufacture of household refrigerators and commercial refrigeration equipment. As part of a general expansion programme the company has now decided to widen its field of operations in the electrical appliance market. Its decision was revealed in an announcement made last month giving details of the Frigidaire "Cascade" spin drier which it is now manufacturing and which was made available to the public



A group of Prestcold executives and distributors' principals at the regional sales conference held at Morecambe. The Mayor of Morecambe, Councillor Mrs. S. L. Birkett, J.P., is centre and on her left is Mr. M. S. Ware, Prestcold commercial sales manager.

on April 1. The " Cascade " spin drier has been developed by Frigidaire engineers in this country and incorporates the most advanced techniques in both design and performance. It will be available from electrical retailers and electricity boards throughout the country at 34 gns., including purchase tax.

* * *

Mr. J. T. Shevill of J. W. Shevill & Son Ltd., Newcastle upon Tyne is here pictured with " Innes-Hopkins " cup which he holds as

winner of the 1957-58 singles golf competition of the Northumberland Provincial Lodge played at the City of Newcastle Golf Club. The smaller trophies include one for holing-in-one on February 12, 1958, at the 11th hole (198 yards) at the same golf club.

* * *

Mr. George Farley, 35, has been appointed to the board of Evaporators Ltd., Shripney Road, Bognor Regis. Mr. Farley joined Lec Refrigeration Ltd. in 1951 as pilot and overseas sales representative. He has been actively associated with Evaporators Ltd. since its inception in 1955.

* * *

Group trading profits etc., of **Negretti and Zambra,** scientific instrument manufacturers, for the year ended September 30 amounted to £311,955 (against £301,655) and net profits to £135,205 (£133,443) after all charges. Group fixed assets at the year-end were entered at £893,731 (£785,596) and current assets at £901,357 (£842,181). A 10-year record of turnover shows that this increased by about £1,000,000 between 1947 and 1957.

* * *

The popularity of exhibitions for the purposes of both consumer and industrial sales promotion is constantly increasing. For those who are embarking in this field for the first time, or indeed, for those who, from experience, know the detail and lengthy contact involved in preparation, **Ripley, Preston & Co. Ltd.** have prepared a 12-page, full-coloured booklet outlining the comprehensive service which they can provide for the exhibitor. It describes how they channel the arrangement of all the necessary requirements—stand design and construction, cleaners, demonstrators, press and public relations, etc. through their own organization, so saving the exhibitor anxiety, time and money. Illustrations show some of the stands for which they have been responsible, including one which won the " Poultry World " Silver Challenge Rose Bowl for the most attractive exhibit at the National Poultry Show in December 1956. An interesting part of the Ripley, Preston service is the construction of a three-dimensional model of any proposed stand, which ensures a proper and practical assessment of the display. Ripley, Preston & Co. Ltd., who have six, self-contained provincial offices, will be pleased to send copies of the booklet on request, from their head office at Ludgate House, Fleet Street, London, E.C.4.

* * *

The directors' report and accounts of **Trawlers Grimsby Ltd.** in recent years have had a distinctive character and have utilized the skills of the illustrator and layout man ; indeed, in 1957, they won the annual award of *The Accountant* journal for the best presented company accounts of the year. The recently published edition for the year to September 30, 1957, maintains this high standard. It is recorded that, in regard to Jackstone Frosters Ltd., a high percentage of the orders executed during the past year have been for export and have also included a number of repeat orders for customers of several years' standing. " Jackstones " are now in operation in over 20 countries. Towards the end of last year plans were completed for the production of a 15-station model to cater for the requirements of large processors.

* * *

The Avon Refrigeration Co. Ltd., main agents for Kelvinator, recently held a delightful function in Devizes, Wiltshire, called a wine and cheese supper. Guests included Mr. M. Thun and Mr. T. D. Edmunds, Kelvinator commercial area managers; Mr. A. J. Rigliani, of Sarum Ice Creamery Ltd.; Mr. G. Cookman and Mr. J. George, of David Owen & Co.; Mr. and Mrs. E. W. Spiller, Midland Bank; Mr. C. D. Thomas, Birds Eye Foods; Mr. K. Holloway, of Holloway & Sons Ltd., Bath. The firm's recently developed Nu-Avon refrigerated counters and cabinets were spoken of highly at this function. The managing director, Mr. I. H. Sercombe, is seen, fifth from the left.

The firm of **Shaw Moisture Meters** has just been appointed as sole British agents for K. P. Mundinger, Germany's leading moisture meter manufacturers. The combined ranges of both firms, totalling 40 instruments, were shown at the Instruments, Electronics and Automation Exhibition.

* * *

BX Plastics Ltd. are extending the manufacture of expandable polystyrene at their Brantham Works. As from April 1, this material is being marketed solely by :—British Resin Products Ltd., Devonshire House, Piccadilly, W.1, under the registered trade mark " Distrene " and Expanded Plastics Ltd., Mitcham Road, Croydon (a subsidiary of Expanded Rubber Co. Ltd.) under the trade name " Polyzote."

* * *

British Resin Products Ltd. announce that the high density polyethylene which they are marketing on behalf of British Hydrocarbon Chemicals Ltd. will in future be sold under the trade mark " Rigidex." Rigidex is made by a process developed by the Phillips Petroleum Company who have licensed the manufacturing rights to British Hydrocarbon Chemicals Ltd., a company jointly owned by The Distillers Company Ltd. and The British Petroleum Company Ltd. The following personnel have been appointed in connexion with the development of the sales of Rigidex : —Sales manager : J. D. Winston ; asst. sales manager : G. E. H. Smock ; development manager : D. N. Davies and service manager : P. Brown.

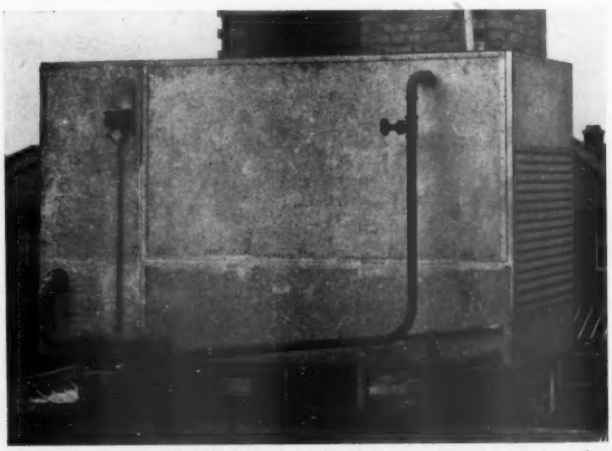
* * *

The latest step taken by **Lec Refrigeration Ltd.** to reduce costs and increase efficiency is the installation of Telex at their Bognor Regis factory. The Lec Telex number is 8687 and the firm will now be able to transmit typed messages direct to any of the thousands of Telex subscribers throughout the world. In addition the machine will receive messages without the attention of an operator when the office is closed at night or during the weekend. The Lec Telex is the only one in their area, the nearest other West Sussex subscriber being 30 miles away at Horsham.

Kelvinator canteen at Bromborough.

Construction of the new **Kelvinator** factory at Bromborough, Cheshire, is now nearing completion and key personnel are gradually being transferred from the Crewe factory. The labour force at Bromborough should increase to around 1,000 by the end of this year ; most of the unskilled workers are being recruited locally. Early last month the new canteen at Bromborough was opened. On the first day the lunch time meal was exceedingly well attended. The catering is handled by contractors, Midland Caterers Ltd., who presented a cake to the management to celebrate the opening. The following week a staff dance was being held in the canteen.

Much interest has been aroused lately in the Silent Falls recirculating water coolers installed on the multiple compressor installations at the various Premier supermarkets. These coolers were specially designed and made by **Mechanical Kold Ltd.** for Premier Supermarkets Ltd. All models were hot galvanized after manufacture. Among the many special features are quietness in running, as the coolers are installed on the roof and in most cases are surrounded by flats and houses. In one case, in order to comply with architects' requirements the cooler had to be below parapet height and was made 4 ft. 9 in. high. The



Photograph shows the SILENT FALLS recirculating water cooler on roof of the Hounslow West Premier Supermarket.

cooling section is divided into separate circuits which enables inspection and maintenance to be carried out without closing down. This is essential in multiple compressor installations. Gravity feeding the water through the cooler enables pump and motor requirements to be of a low h.p. Silent Falls water coolers, in many sizes, covering a wide range of duties, are now available to the trade.

* * *

A new tool which will be of great value to engineers and maintenance workers in most industries has been introduced by **J. W. Pickavant & Co. Ltd.**, of Birmingham, well known for their Apkoway tools and hydraulic equipment. The new addition to

the Apkoway range is a hose clip tool designed to aid the speedy and safe fitting and removal of clips of the Cheyney, Collier, Jubilee, Terry and similar types. It incorporates a specially hardened spring-loaded screwdriver bit that enables the hose clip to be firmly gripped whilst the adjusting screw is tightened or released. Easier to use than an ordinary screwdriver, the new tool eliminates the danger of injury due to slipping and saves a great deal of time. Measuring 9 in. long and weighing only 6 oz., this latest Apkoway tool is most convenient to carry. It has a bright nickel finish as a protection against rust.

* * *

Refrigeration (Mitton) Ltd., of "Prestcold" House, Carlisle, the "Prestcold" distributors for the north of England and south-west Scotland, have recently installed a

shopfront and refrigerated window to the latest conversion at the premises of an old family butcher concern, Messrs. Wilson, of Egremont, Cumberland.

Egremont is a small Cumberland town some six miles from Whitehaven with a low income population of some 7,000. It could be said that this small family business of some 50 years or so standing, and situated in this backwater of Cumberland, has given a lead to many city shops in the way of investment in hygiene, and that it has shown no little pride in the manner in which the family business considers meat should be handled at the point of sale.

The refrigeration unit consists of the latest type Prestcold Super-Presmetic, rating ½ h.p. AR.50 condensing unit, and this is neatly tucked away in a ventilated compartment under the window base. Incorporated in the display base, and embedded in the insulation, is a ½-in. O.D. pipe coil. A "fly-discouraging" window coil is installed at a high level in the upper display section of the window.

Mr. C. R. Purley (left), of Lec Refrigerators Ltd. with Mr. Richard Summers, chairman of John Summers & Sons Ltd., at the British Council Theatre, Hanover Street, London. The occasion was the preview of a 20-minute film describing the qualities and manufacture of John Summers's "ZINTEC" galvanized sheet steel.

SHOP REFRIGERATION NEWS

An Open-Fronted Fish Shop

Complete Refrigeration. Adequate Protection. Official Commendation

By our Special Retail Correspondent

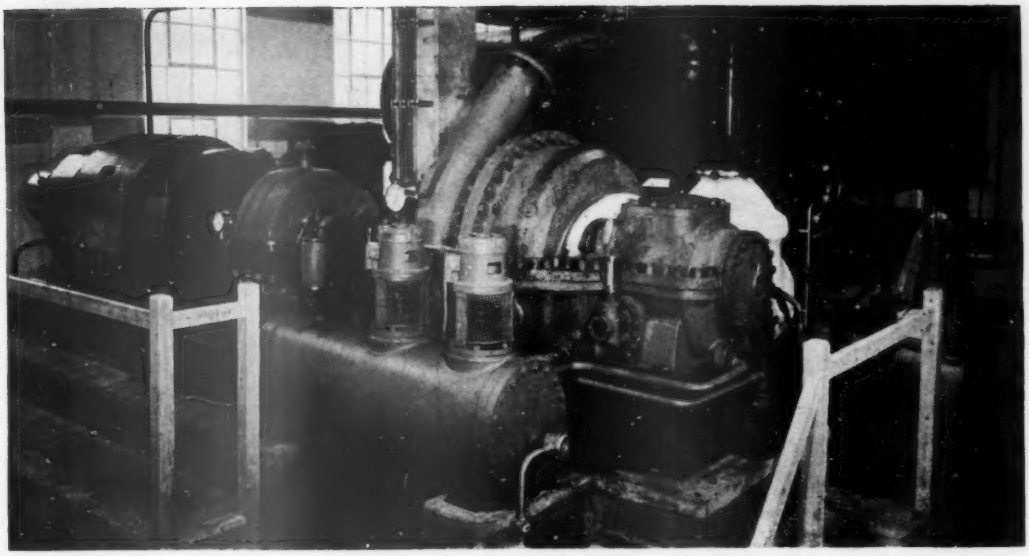
IN the brochures sent out by the White Fish Authority to encourage retail fishmongers to improve their premises, all the shops illustrated have plate-glass fronts. And the tendency to-day is towards the closing in of all shops selling food. Butchers seldom now have their stock exposed to street dust and industrial smoke, grocers and provision-merchants accept the closed-in shop-front as a matter of course : yet a large proportion of fishmongers still insist that the only satisfactory way to sell fish is in an open-fronted shop. If the butcher can successfully sell meat behind glass, it is difficult to understand why *all* fishmongers cannot do the same with fish.

There is a sharp cleavage of opinion on this subject in the fish trade : though I do not think it would be incorrect to state that most of the *new* fish shops opened to-day have glass fronts. The W. F. A., while leaning noticeably in the direction of the closed-in front, has not yet become dislodged from its fence of neutrality. Under the heading " Open or Closed Front " in its first report* the fishmongers' study group states :—

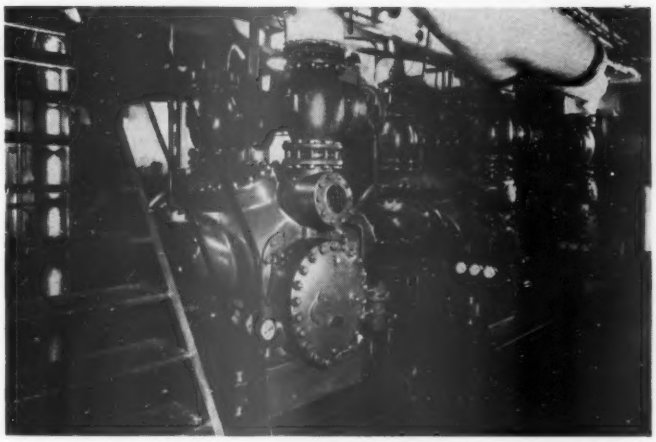
" Although from the hygienic point of view the closed-fronted shop is to be preferred, there is no objection to any trader who prefers it, having the open-type shop provided that the fish displayed has adequate protection to comply with reasonable hygiene requirements and that steps are taken to ensure that flies, dust, and street fumes are excluded from contact with the merchandise. *The closed-fronted shop is, however, more in keeping with modern tendencies and lends itself more easily to the use of attractive materials and good design. This is particularly important when considering the appeal to the younger housewife.*"

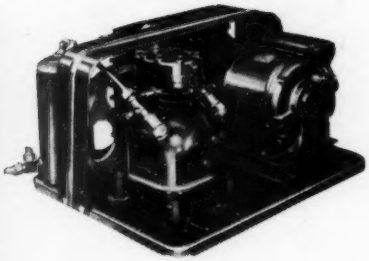
The emphasis of the last two sentences is mine. But it is certainly correct, and only fair, to add that some owners of open-fronted shops are

* White Fish Authority : Report of the Advisory Panel on the Improvement of Retail Fish Sales. W. F. A. Price 1s.



Refrigeration for all Commercial and Industrial Purposes





J. & E. Hall Ltd. manufacture refrigerating compressors for all commercial and industrial purposes ranging from $\frac{1}{6}$ h.p. to over 1000 h.p.

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DARTFORD KENT *Tel : DARTFORD 3456*

REFRIGERATION, LIFT AND ESCALATOR ENGINEERS

AP 115

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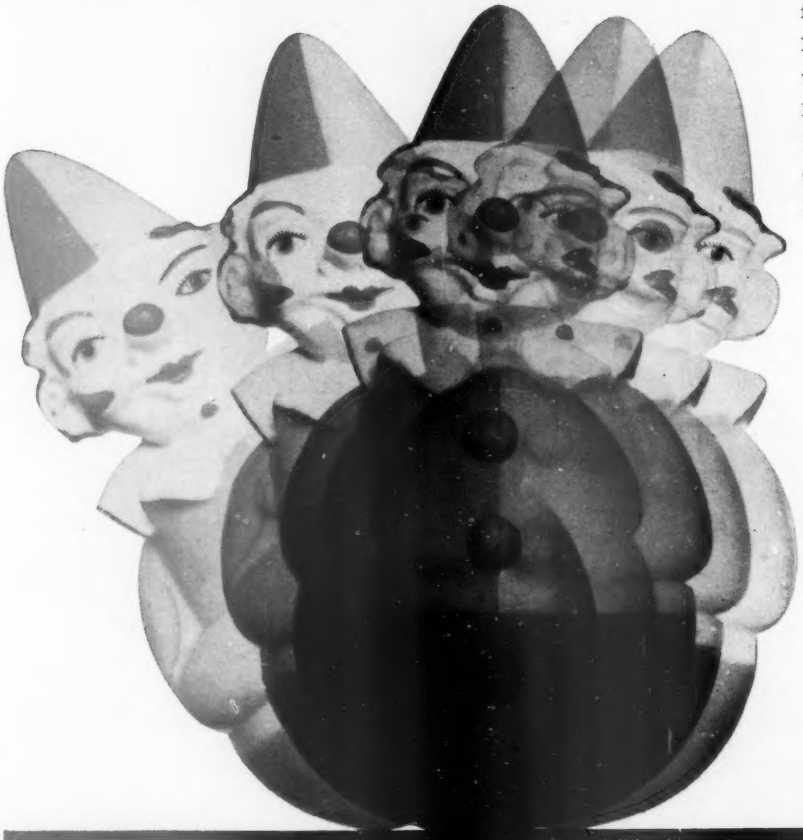
ROCKSIL—for either hot or cold insulation—has many important advantages to offer. Probably the most outstanding is its combination of strength with resilience—'rigid' resilience that absorbs impact and stands up well to considerable deflection of the surface it is protecting. In bonded slab form of various thicknesses and densities this makes Rocksil ideal for casing and structural insulation. It will not settle under continuous vibration even as loose infill. Rocksil is produced from natural Scottish rock and is odourless, chemically inert and sulphur-free, non-hygroscopic and rot-proof.



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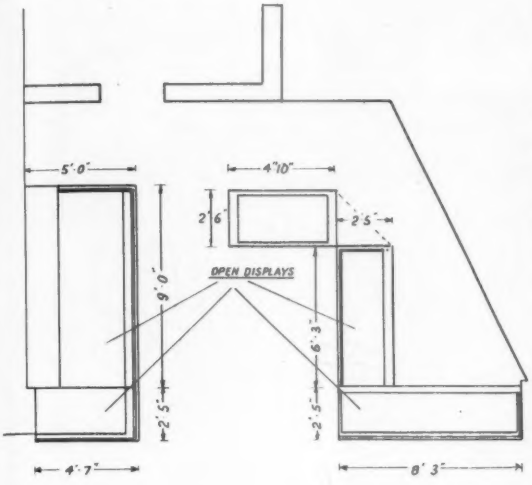
Manchester: Floor D, National Buildings, St. Mary's Parsonage, Manchester 3 Tel: Deansgate 6016-7-8

Birmingham: 11 Waterloo St., Birmingham 2 Tel: Midland 6565-6-7

Newcastle: 19 & 20 Exchange Buildings, Newcastle-upon-Tyne Tel: Newcastle 20488



The layout of the shop under discussion.

acutely conscious of the need for greater regard for hygiene and for higher standards of presentation, as exemplified by the combined use of protective glazing and refrigerated surfaces for the displayed products.

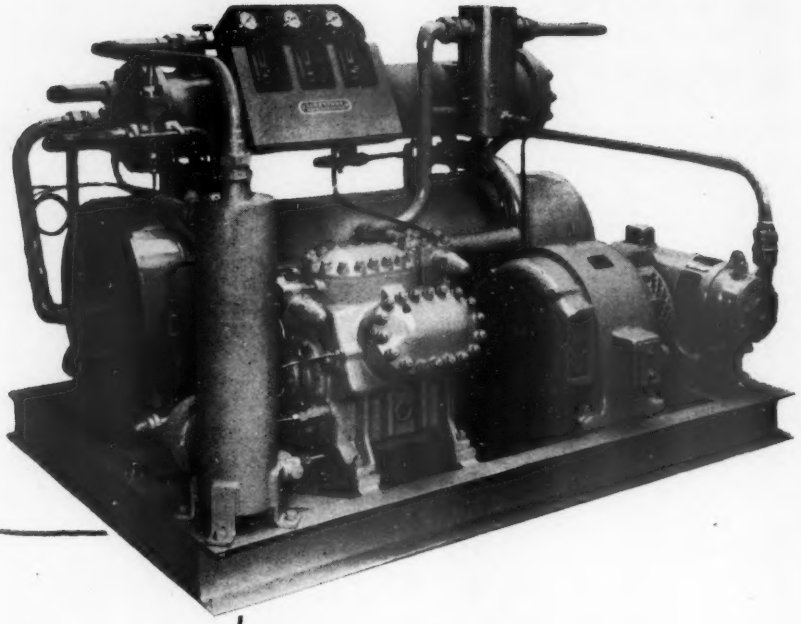
It would be difficult to find a better three-dimensional testimony to this fact, among the open-fronted shops, than the recently transformed premises of G. E. Wake, Ltd., at Coventry. One possible justification for the use of the open front here—that it provides more space for quick service from the displays—is made evident by the accompanying illustrations.

There are five refrigerated display cabinets, each of which is a specialised department. Everything is served from the glass-protected, clearly visible, temperature-controlled displays, and mostly *over* the cabinets on the right, by assistants standing in attendance *behind* the cabinets and from the front of the cabinets on the left ; so that, although there is no flat surface, nor even rack in front, for the support of customers' hands, handbags, or baskets, these cabinets do take the place of counters.

The two cabinets facing, running parallel with, and very slightly abutting on to, the public pavement are movable ; being fitted with castors, plugged into the electric circuit with long flexes, and having sunken handles. They can thus be moved back into the shop when the time arrives to lower the revolving shutter which closes the shop by night. Both these cabinets are self-contained, each having Yorkometric refrigerating machinery respectively BH3 AM12 with $\frac{1}{3}$ h.p. motor, and BH5 AM12 with $\frac{1}{2}$ h.p. motor, installed beneath the display area, in conjunction with louvred air inlets in the lower front panel which slopes slightly inwards towards the recessed plinth.

Respective lengths of these two cabinets are 4 ft. 7 in. (left) and 8 ft. 3 in. (right) and they are 2 ft. 5 in. deep (from front to back), and 3 ft. 6 in. high to the top of the glass screens in front of the refrigerated display area, beneath which are suitably insulated eutectic plates. None of the cabinets is a standard model : all were designed to meet the requirements of the shop. This

A general view of the re - planned, re - equipped, open-fronted shop of G. E. Wake, Ltd., with all displays refrigerated.



NEW PACKAGED WATER CHILLER

We illustrate our 10 horse power packaged water chiller which is being exhibited at the Brussels World Exhibition 1958.

This unit is the smallest of an entirely new range of packaged water chillers which are available in graduated capacities up to 100 horsepower.

Complete and ready for connecting to water and electrical supplies, why not save time, money and above all space by specifying Lightfoot Packaged Water Chillers ?

The Engineering Centre Group Stand
BLOCK C
BRITISH INDUSTRIES PAVILION

by **LIGHTFOOT REFRIGERATION**

Leaders in specialised installations for over 70 years

THE LIGHTFOOT REFRIGERATION CO. LTD., ABBEYDALE ROAD, WEMBLEY, MIDDLESEX

is made evident by a glance at the second and third illustrations from which it will be noted that the ends of the two front cabinets are shaped to conform with the fronts of the two running at right-angles. The respective lengths of the latter are 9 ft. (left) and 6 ft. 3 in. (right) the one on the left being continued back to a depth of 5 ft. to form a slab with a marble-topped riser behind it. The respective condensing equipment is BH10 MW12 with 1 h.p. motor and BH3 MW with $\frac{1}{3}$ h.p. motor.

The cabinets on the left have no back space, service being given from the front. The end of the movable cabinet is shaped to conform with the frontal line of the fixed one.

At the back of the open central space and facing the front of the shop is a quick-frozen food cabinet 4 ft. 10 in. long by 2 ft. 6 in. deep (from front to back), coupled to a BH7 MW12 condensing unit, driven by a $\frac{1}{3}$ h.p. motor. The three last-mentioned cabinets are operated by condensing units in the cellar which, owing to inadequate ventilation, are water-cooled.

The four cabinets held at normal cooling temperature have non-refrigerated showcases at middle level in which proprietary cartoned, canned, and bottled products are featured behind sliding glass doors. York Shipley equipment was used throughout, and the installation was carried out by Kroy Refrigeration, Ltd., to whose sales manager, Mr. W. Beer, I am indebted for co-operation in compiling this description.

Since it contributes so much to the attractions of this shop, it is only fair to mention the method of lighting which is noteworthy for being planned to meet the requirements of this kind of display. Gearless fluorescent lighting by Philips Electrical, Ltd. is used ; the enclosing fittings being fixed in a single line just below and about 2 ft. 6 in. back from the fascia level. Each section in this run consists of twin fluorescent lamps operating in series with two tungsten ballast lamps which control the current and produce additional light. The tungsten lamps are half-silvered and the fluorescent lamps are partially concealed by plastic louvres.

GUILDFORD'S NEW CONTINENTAL DELICATESSEN

The photograph overleaf shows an 8-ft. " Marquis " (temperature 35° to 40° F.) shelf model—an 8-ft. " Woking " closed display case with marble serving top and an 8-ft. " Marquis " (–5° F.) cabinet with mirror canopy installed at Richard Anthony & Co. Ltd.'s new delicatessen shop in Guildford.

This shop is so designed to give part self-service —the medium temperature open display lending itself to this. The Marco " Marquis " range is adaptable to temperatures of from –5° to +45° F. Fully automatic electric defrosting is provided by means of time clocks—no drain being required—the entire water from a defrost being dissipated by the head line. In addition to the above 24 ft. of display, a 40-c.ft. service cabinet is installed at the rear of the premises.

The new fully refrigerated premises at Guildford.

The entire recommendation and layout were given to the owners, Messrs. Richard Anthony, by Messrs. Seldon & Co. (Guildford) Ltd.—Marco distributors for Surrey, who supplied and installed all the equipment and were also responsible for the shadowless lighting which consists of nine cold cathode tubes—six white and three gold.

TRADE WITH CUBA

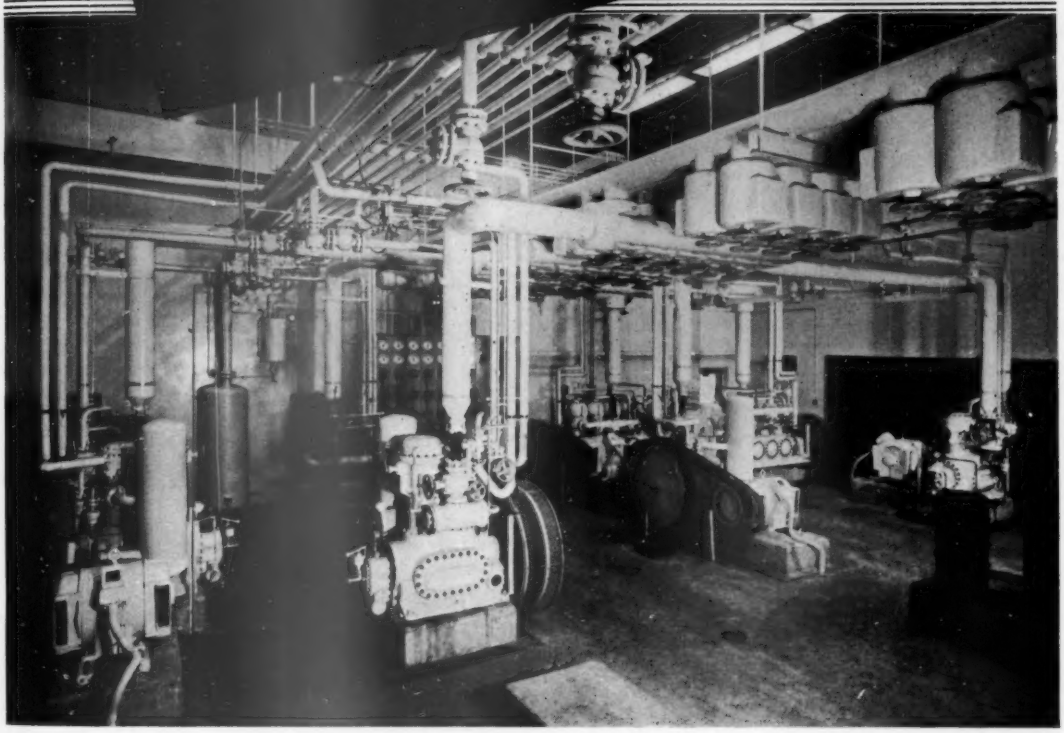
The British Embassy, Havana, has received a leaflet from Compania Commercial Maritima de Matanzas S.A. of Apto. 190, Matanzas, Cuba, who are the administrators of the free zone of the Port of Matanzas and who are anxious to encourage United Kingdom manufacturers and exporters to ship goods to the free zone on consignment or to order. Merchandise may be received from overseas on consignment by importers of this country or " to the order," it being indispensable that such merchandise is expressly consigned in the ship's manifest as well as in all the documentation, it being clearly stated that the destination is the free zone of the Port of Matanzas. The merchandise received can be stored in warehouses and go-downs and remain there for up to six years without any necessity for the payment of customs duties nor internal taxes by reason of it being within the free zone. The entrance, dock and storage charges in the free zone are attractive and the organization that administers the free zone wishes to be consulted whenever anybody has any interest in this proposition in order to demonstrate its wish to lend its service for the good of the community. Some of the advantages of the free zone are : 30 days' free storage after reception of the merchandise, subsequently up to $1 per ton per month or part of a month in covered storage space, or 50 cents per month or part of a month in the open.

More Self-Service Conversions

PAISLEY and District Co-operative Manufacturing Society Ltd. have opened a new self-service store in the George Street area of the city where rebuilding of housing has been progressing in recent years. In the first week of its opening, trade was doubled. The Paisley Society was a late-comer to self-service operation, the general manager indicated after this opening, but it has now been completely won over to this form of trading on the evidence of successful conversions at other points in their area and by this latest changeover. The society now operate six self-service shops, all opened within the last 18 months, including one of the smaller " pantry " shops which have been featured by the Scottish co-operatives in their self-service programme.

Renfrew Co-operative Society, Ltd. also has opened a modern self-service shop at Kirkland Neuk, Renfrew, covering all sections of food trading. Private grocery self-service units in Scotland have been rather rare but one such unit has now been opened at Alford, in Aberdeenshire, by Gordon's of Alford, covering a full range of food services.

KRAFT install STERNE



The photograph above shows part of the refrigeration engine room in the new factory for Messrs. Kraft Foods Ltd., at Kirkby near Liverpool.

L. STERNE & CO. LTD

(Incorporating Haslam Foundry & Engineering Co. Ltd.)

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Refrigeration Controls—5

PRESSURE-OPERATED TYPES

By H. H. EGGINTON

(*Continued from April issue*)

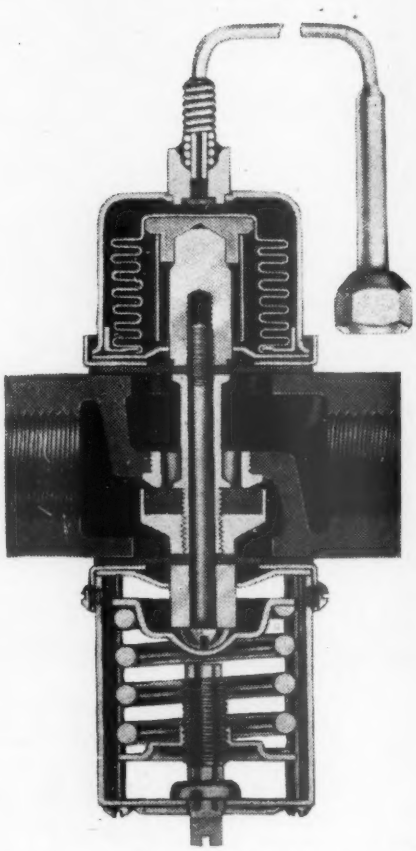
Water Valves

WITH a compression machine the amount of work undertaken in the compressor is a function of the evaporator and condenser pressures. For any given application the former is reasonably constant but the condenser pressure will vary with the temperature of the air or water conducting heat away from the machine. Thus, for a given amount of duty the compressor load and therefore the electrical or other primary power load can be balanced against the cost of supplying cooling water to maintain a limit on the build-up of condenser pressure, which will limit the maximum electrical or other load. In all water valve applications the cost of water can be balanced against power costs to give the most economical running conditions as long as these are not taken to extremes and fundamentally upset the machine operation.

Two principal methods of water cooling can be used—(1) an " on/off " valve (2) pressure operated modulating valve. The former is usually a solenoid or magnetic valve, switched on with the machine and throttled to the desired water flow with a hand valve. Such systems do not give the sensitivity or economy of the second type, which by tapping the compressor discharge or high side condenser pressure opens or closes the water orifice to the condenser, as the heat, and therefore pressure, loads vary. Properly adjusted, such valves stop the water flow on the " off " cycle of the machine and during the " on " cycle modulate to balance the heat load from the machine by increasing or reducing the water flow. The pressure-operated type only is referred to in the following comments.

Principal Requirements

Pressure-operated water valves in their commonest form are basically simple instruments, comprising bellows opposed by a spring which according to the pressure fed into the bellows moves a valve to allow water to flow—increase in pressure opening the valve and fall in pressure closing it. The amount of spring load opposing the bellows determines the point at which the valve is set to open and close. (See fig. 9 and 10.)



By courtesy of Penn Controls Inc., U.S.A.

Fig. 9.—Penn series 246 water regulating valve. Typical cross section of threaded type showing principal parts. Interior of flange models is similar.

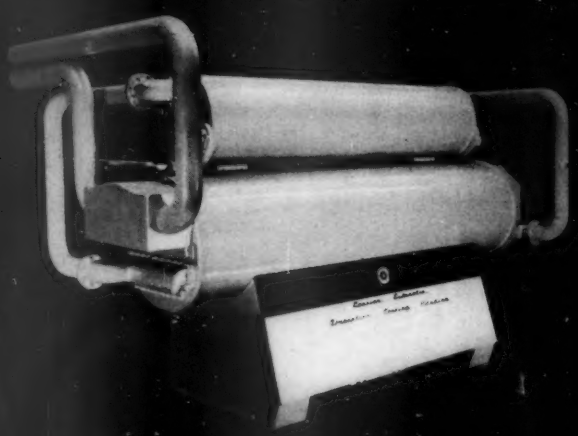
COOL IN SUMMER

using a

HOT

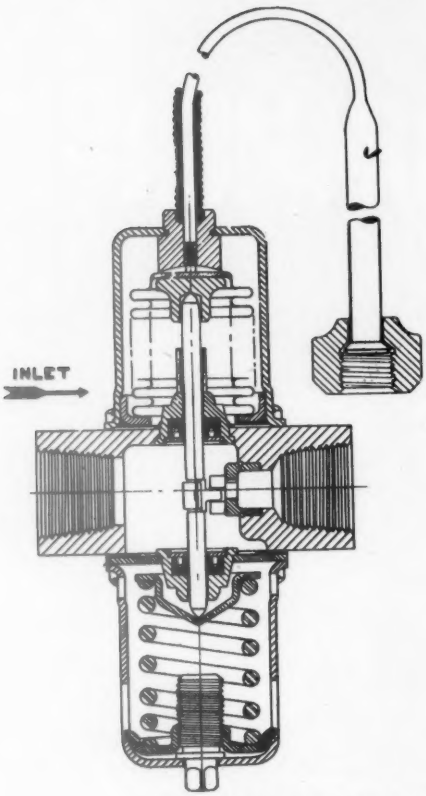
WATER

BOILER !



Carrier

REFRIGERATING MACHINE



By courtesy of A.P. Controls Corpn., U.S.A.

Fig. 10.—AP model 65 water regulating valve. Cut-away view. Note direction of water flow through the valve.

(1) The valve must be robustly made to deal with high side and water pressures.

(2) The valve should be so constructed that changing water pressures do not affect the opening and closing points.

(3) The valve should go from fully closed to fully open in 40 to 90 p.s.i. pressure change in the power element, and have a hysteresis of not greater than 3 to 5 p.s.i.

Range requirements depend on the refrigerants, but generally are between the limits 30 to 300 p.s.i., fully closed to fully open, respectively. Often two valves are used for such ranges, say 30 to 200 and 130 to 300 p.s.i., although a range 30 to 250 p.s.i. will deal with most requirements.

Construction

Most water valves follow a fairly common constructional pattern with one of the principal requirements being corrosion resistance of the water compartment sections. As a rule, brass and gunmetal bodies are most common, the latter type generally being selected for marine applications ; on some of the larger types of valve, heavy cast iron construction is used for the body. It is quite common for the valve seats to be inserts in bronze, monel or stainless steel to resist the erosion effects of the water and make service or reconditioning easier. Valve heads are often of synthetic rubber or plastic with metal heads of monel occasionally used in arduous conditions.

Bellows prime movers are nearly always used to effect the valve movement required which is normally $\frac{1}{4}$ of the valve diameter. This being theoretically the amount of opening of a flat valve to achieve flow equivalent to the unrestricted round orifice.

If poppet type or needle and seat type valves are used, water flow should be through the seat and over the valve head to avoid water hammer.

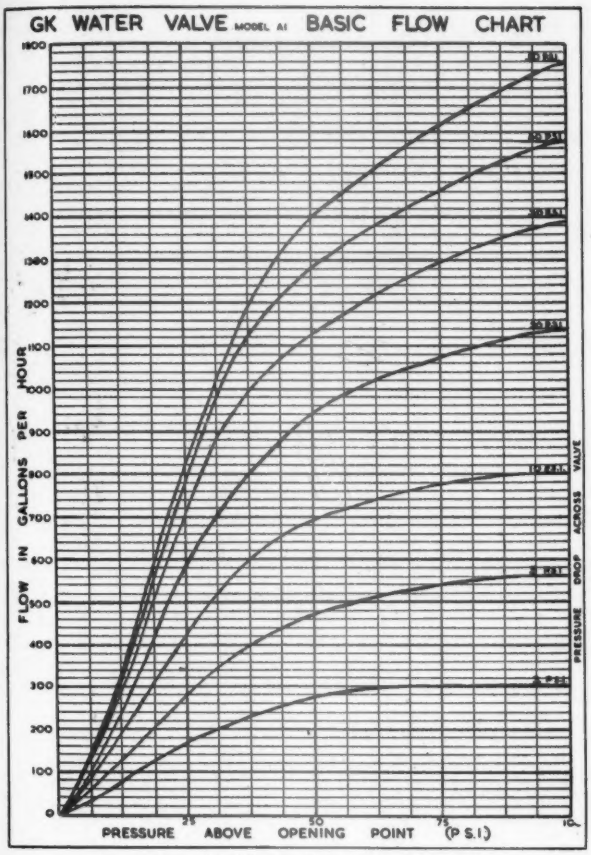
The valve should have a smooth action, *i.e.* little frictional hysteresis, and shut effectively.

Operating Characteristics

It is vital to appreciate that the pressure operated water valve has a throttling range, that is a given pressure change is required to move the valve from closed to open position, and in this class of instrument practically the widest throttling range of any refrigeration control is used. As stated above, this varies from approximately 40 to 90 p.s.i., depending on the type of refrigerant and the make of valve. The amount of water capable of flowing through a valve varies therefore with :—

(1) The valve size.
(2) The amount of opening of the valve.
(3) The water pressure drop across the valve, *i.e.* the difference between inlet and outlet pressures.

With regard to (3), most manufacturers give capacity tables or graphs for three or four inlet water pressures and assume the valve will be used with virtually no restriction on its outlet side; alternatively, the user will subtract condenser and pipework pressure drops from the water feed pressure to obtain the pressure drop across the valve, and apply this value to the graphs. Valve characteristics are that from the opening point increasing water flow results from increasing compressor discharge pressure until the valve is flowing to the maximum for the orifice size. (See fig 11.) Further increase of condenser pressure cannot be compensated by water flow after this point and therefore it is desirable to ensure in any valve that the maximum amount of water required for any application does not exceed this point. It is safer to choose a valve which will give the maximum required amount of water—some 10 to


GK WATER VALVE MODEL A1 BASIC FLOW CHART
FLOW IN GALLONS PER HOUR
PRESSURE DROP ACROSS VALVE
PRESSURE ABOVE OPENING POINT (P.S.I.)

By courtesy of Teddington Refrigeration Controls Ltd.

Fig. 11.—Water valve capacity chart.

20 p.s.i. pressure before the flow limit of the valve is reached. The tables and graphs provided by most manufacturers quote flow of water in gallons per minute against head pressure above opening point. This pressure must not be confused with the actual head or condenser pressure. It is the increase in pressure above the pressure at which the valve starts to open. With a pressure-operated water valve the discharge pressure should remain reasonably constant irrespective of the heat load on the machine, because the changing heat load which would affect the discharge pressure is immediately compensated by increase or decrease of cooling water, thereby stabilising the discharge pressure. This means that within reasonable limits, the electrical or primary power load is kept constant and the working stresses in, and efficiency of, the machinery can be maintained at optimum conditions. Since the pressure-operated water valve operates on the condensing unit the pressure of the condensed refrigerant is fairly constant and in turn the difference in pressure between the high side and low side. The pressure drop across the refrigerant metering device, *e.g.* the expansion valve, is therefore also maintained fairly constant whilst the machine is running.

Application

Before any decisions on economy of running can be taken it is essential to know the water capacity of any given site, *i.e.* pressure pipe sizes, and therefore flow limits, and the mean temperature of the water supply. The latter is most essential because it automatically fixes the lower range of the condensing pressure and within certain limits the water capacity determines the permissible maximum size of the machine.

The instrument should be selected according to the pressure range required by the refrigerant and the water feed temperature, bearing in mind that it will be impossible to have the valve working at pressures lower than that corresponding to the refrigerant pressure at the water temperature. The cost of water in a particular district may demand working at higher pressures and will increase the power cost but will achieve an overall economy by balancing water and power charges. As a rough guide it will be found that 50 to 100 gallons of water an hour will be required per horse power. The higher flow will be required for air conditioning and the lower for low temperature work, with general commercial requirements in the 70 gallon per hour range. Under these approximate conditions the temperature of the cooling water can be expected to rise by some 15 to 20° F.

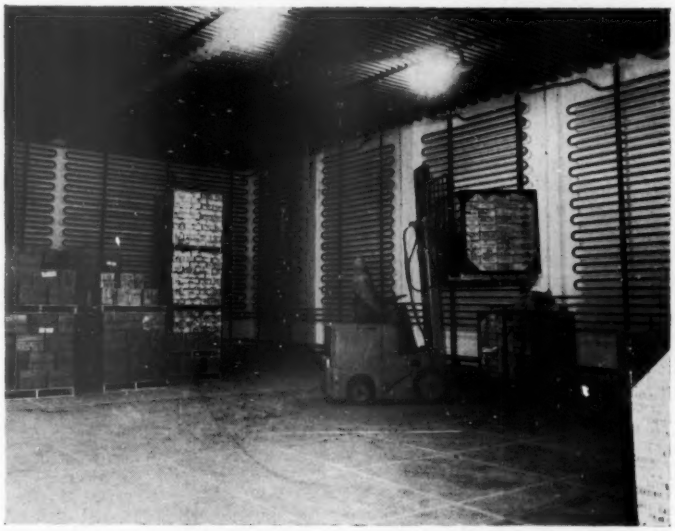
(*Continued on page* 502)

Rapid Progress of Large-Scale Projects

Enormous developments in cold storage are now taking place. Smiths Insulations Ltd. are using new techniques to build some of the largest and most efficient cold stores in the world, much more quickly than was hitherto possible. Photographs on left show progress on (1) a sub-zero store of one million c. ft. capacity ; (2) a simultaneous contract for a 600,000 c. ft. low temperature store.

Other contracts proceed at the same time for large fish, food, ice cream and beer stores. Our 84 years' experience and resources enable us to offer a complete service in the design and construction of cold stores of any size. By our methods of prefabrication, building time and costs are greatly reduced, and completion speeded up.

WATCH FOR FURTHER ANNOUNCEMENTS OF THESE VAST DEVELOPMENTS AND FOR WHOM THEY ARE BEING UNDERTAKEN.



This photograph shows a section of a new fish store recently completed in Hull. It has a capacity of 200,000 *cubic feet, with labour-saving palletization, giving low running costs.*

Installing the Valve

The fitting of a strainer preceding the valve is strongly to be recommended as a means of lengthening the useful life of a valve and possibly stopping frequent service calls. The installation of the pressure tapping should be made so that the least possible pulsation from the piston of the compressor is transmitted to the prime mover of the valve, otherwise fatigue failure of the prime mover may occur—perhaps with loss of refrigerant. Although valves are made with capillary tube connectors, this, unless very long, will not suppress pulsation if a poor tapping point is made.

Setting

The valve should be set to open not less than 10 to 15 p.s.i. higher than the refrigerant pressure at the water temperature, for example :—

Water temperature	50° F.	70° F.
Methyl chloride at water temperature	37·5 p.s.i.	59 p.s.i.
Valve set to open 37·5 + 10 =	47·5 p.s.i.	59 + 10 = 69 p.s.i.

This will ensure that the valve closes on the off cycle. If the valve is set to close appreciably lower than the above recommendations, the water temperature maintains the condenser temperature and hence pressure and as a result the valve remains open during the off cycle, thereby wasting water.

A system which has collected air in the refrigerant after the valve was set will exhibit symptoms of "valve set low" by giving water flow on the off cycle, but the head pressure temperature relationship will not be correct for the refrigerant, the pressure being too high.

Symptom	*Remedy*
Valve leaks copiously on off cycle.	Check condenser pressure and temperatures to ascertain if air in system. Purge. Re-set valve to open 10 to 15 p.s.i. above the refrigerant pressure for the water temperature.
Minor valve leak (check first as for copious leak).	Check valve is not fitted backwards —some valves depend on water pressure to make tight. Dirt clogging valve—holding off. Clean and fit suitable strainer. Valve eroded or corroded—replace.
Valve hammer.	Check valve fitted correct way. Valve oversize—fit smaller.
Condenser pressure rising abnormally. Little water flowing.	Ascertain supply of water is satisfactory. Check setting against water temperature and gauges. Check change in water pressure or against setting and valve capacity. Valve blocked clean and fit strainer. If range spring has to be unloaded an excessive amount to get water flow—check bellows failure. Replace.

British Plastics Year Book, 1958 : a classified guide to the plastics industry. 28th edition. Published by Iliffe & Sons Ltd. Price 42s. net (postage 1s. 9d.). Size 9¼ in. × 6¼ in. 816 pp.

This edition of "British Plastics Year Book" has been thoroughly revised and it has now been divided into eight sections. Three are devoted to classified lists of manufacturers and suppliers of materials, finished products and equipment, while a fourth section contains the world's largest list of trade and proprietary names connected with the industry, covering materials as well as finished goods.

Each trade name is followed by a definition of the product and the manufacturer concerned. A glossary of plastics technical terms is also included in this section.

The names and addresses section contains nearly 4,000 firms associated with plastics, grouped into countries, and the Who's Who section lists names and positions of prominent people actively engaged in the industry in Great Britain.

The review of patents issued during the previous year has again been included, collected under subject groups each of which has been abstracted and prefaced by an expert ; this provides a valuable record to technical developments in the industry. Also, a set of tables giving comparative properties of plastics materials is included for the first time in the year book.

Makers of refrigerator fittings and accessories and of refrigerator panels are listed ; there are 77 in the former group and 22 in the latter.

British Ice Cream for Brussels

British ice cream from Greenford, Middlesex, bound for Brussels, Belgium, is being shipped daily to the Continent throughout the six months of the Brussels Fair, which opened last month. The ice-cream—ranging from choc-ices to Neapolitans for wafers, and frozen stick confections—is for the Lyons Maid sundae bar at the British Industries Pavilion. Visitors from all over the world—trade and public alike—are able to sample the high quality of ice cream "made in Britain."

Iraq Fair

The commercial section of the Iraqi Ministry of Foreign Affairs has announced that the local administration in Baghdad plans to hold an agricultural and industrial fair on a site of 70,000 square metres at Al Mansur. The purpose of the fair is to display Iraqi and overseas manufactures and products as well as machinery, agricultural implements and other materials used in the development of industry, agriculture and trade. The layout of the fair has been designed by a British architect having a wide experience of trade fairs. About 100 Iraqi and non-Iraqi firms have so far indicated their intention to take part in the fair ; various Iraqi ministries and official and semi-official departments are also preparing exhibits. Areas ranging from 100 to 3,000 square metres have been taken. The fair will open on October 15 and run for two or three weeks.

Reports of Progress within the Machinery and Insulation Industries

60

Machinery

U.S.A.

(*Continued from April issue*)

" O, man ! admire and model thyself after the whale !
Do thou, too, remain warm among ice . . .
Be cool at the equator ; keep thy blood fluid at the Pole.
Like the great dome of St. Peter's, and like the great whale
Retain, O man ! in all seasons a temperature of thine own."
From " Moby Dick." By Herman Melville.

THERE are many industries, indispensable servants to mankind, that have made historic contributions to the welfare and comfort of our everyday lives, to the growth of our economy, and to the expansion of our industrial, commercial and residential development.

Among them is the refrigeration and air-conditioning industry, in which the York Corporation has had a long, uninterrupted and illustrious career.

It was the year 1874—Ulysses S. Grant was in the White House. This was two years before Bell invented the telephone, three years before Edison's talking machine and four years before his incandescent lamp. The current United States census showed a population of about 38,500,000. The country was in the throes of a " secondary post-war depression " which had begun with a panic and bank failures, one year earlier, and was to last for six years.

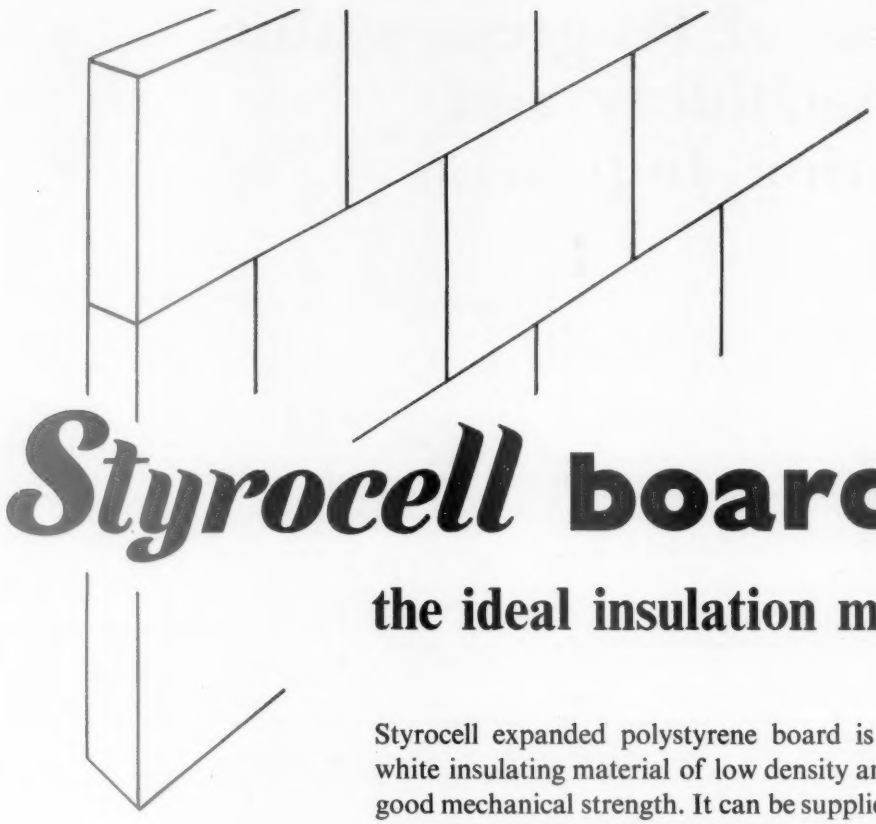
It was on September 2nd of that year that six courageous men pooled their separate interests and possessions to establish the business that grew and expanded into York Corporation. Although their individual holdings were unrelated, they had one common interest. They had a consuming ambition to start a business and a personal urge, stemming from pride of invention, to produce and sell the creations of their own minds and talents.

At its founding, the corporation's single manufacturing establishment was housed in a two-story building 70 ft. long by 40 ft. wide, with about 5,600 sq. ft. of area.

From that early and modest beginning the York Corporation has become one of the leading manufacturers of refrigeration and air-conditioning equipment in the entire world.

Its facilities, to-day, comprise two separate plants, one on Roosevelt Avenue and one in the Grantley section of York,

York Corporation's West York plant.



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covering, in the aggregate, an area of 88 acres with a working and storage space of over 1,821,175 sq. ft.

The entire personnel in 1874 consisted of 14 employees, strictly local in their range of activities. The organization now comprises 5,000 employees of world-wide proportions with research, design, development and manufacture concentrated at York and with distribution and construction either directly through 46 domestic districts and branches, or indirectly through approximately 3,000 domestic distributors and dealers and export agencies. Nine hundred and sixty-five of the employees have been with the corporation continuously for over a quarter of a century.

In 1874 the corporation manufactured patented turbine water wheels, the "Success" washing machine, a clothes wringer, a limited line of agriculture machinery and, later, vertical steam engines that served the needs of paper, lumber and flour mills.

In 1865 the corporation took a step prophetic of its future. It built its first ice machine and, as a hall-mark of confidence in its products, installed it for a customer in distant Mississippi.

That entry into the refrigeration and ice-making field was linked with the decision to concentrate the corporation's entire efforts on the development, manufacture and distribution of refrigerating machinery, exclusively.

It was in this laboratory in 1903 that all leading manufacturers of refrigerating machinery of the era, known as the Ice Machine Builders' Association of the United States, conducted a series of tests on York compressors and set a universal standard for rating compressors on what was required to produce a ton of refrigeration.

The corporation's emphasis on long-range scientific research and development as a base for constructing future growth is exemplified by the construction on its Grantley site in 1954 of a new research and engineering laboratory which greatly enlarges the scope of this vital activity. This modern building is 240 ft. long and 150 ft. wide.

In 1935, York produced the first commercially successful single-room air conditioner in the United States, and in 1948 York was the first to introduce hermetically sealed refrigerant circuits in these units. In 1953 York adapted the heat-pump principle to its room air-conditioners in the ½- and 1-h.p. sizes so that they now provide a supplementary source of heat, thereby extending the period of usefulness from early spring until late fall.

In refrigeration, today's market has broadened into many and diverse industrial and commercial operations. It is used in refrigerated warehousing, bakeries, dairies, ice cream plants, and in connexion with beverage bottling and meat packing. Besides serving as a preservative in the food industry, mechanical refrigeration is of primary importance in processing, quick-freezing and in preparing concentrates. Mechanical refrigeration is an increasingly significant element in the manufacture of chemicals, plastics, refined petroleum products, synthetic rubber and paint, and in low-temperature testing facilities of the aircraft and automotive industries.

Packaged automatic ice-making equipment producing crushed or cubed ice at the point of use is in demand by hospitals, restaurants, bars, food markets, hotels, and in connexion with the handling of fish, vegetables, and other foods. York markets six models of "ice machines," capable of producing ice fragments at rates ranging from 200 lb. to 15 tons per day, and a line of York automatic ice makers which produce per day up to 8,000 cubes or 450 lb. of uniformly crushed ice.

THE VILTER MANUFACTURING COMPANY

THE foundations of the company were laid in 1867 when Peter Weisel equipped a machine shop in Milwaukee for general jobbing and the manufacture of slide valve engines. At that time, steam was the only power in general use and the business prospered. Shortly afterward, Ernest Vilter became a partner and the firm was then known as Weisel and Vilter.

The young company was quick to sense the need for improved products. As a result, in 1880 when more economical steam engines were required, Weisel and Vilter designed a line of Corliss steam engines which were added to the standard products of the firm. In addition, the company recognized the need for refrigeration machinery and in 1882 produced a line of horizontal double-acting compressors which were to be driven by steam engines. This type of compressor together with the required condensers, expansion coil, etc., was sold to ice plants, breweries and packing houses.

Even today, over 70 years later, some of the equipment built at that time is still in operation.

During the first 20 years of life the Weisel and Vilter Company produced a variety of products in addition to the Corliss engines and refrigeration equipment. Among these were pasteurizers, mash tubs, vacuum pumps, bottle fillers, bottle washing and rising machines, corkers, cold briquette units, etc. It was during this period that Ernest Vilter's sons, Theodore, William and Emil as well as Edward Goes, became associated with the company. A corporation was formed in 1886 and 600 shares of common stock were sold.

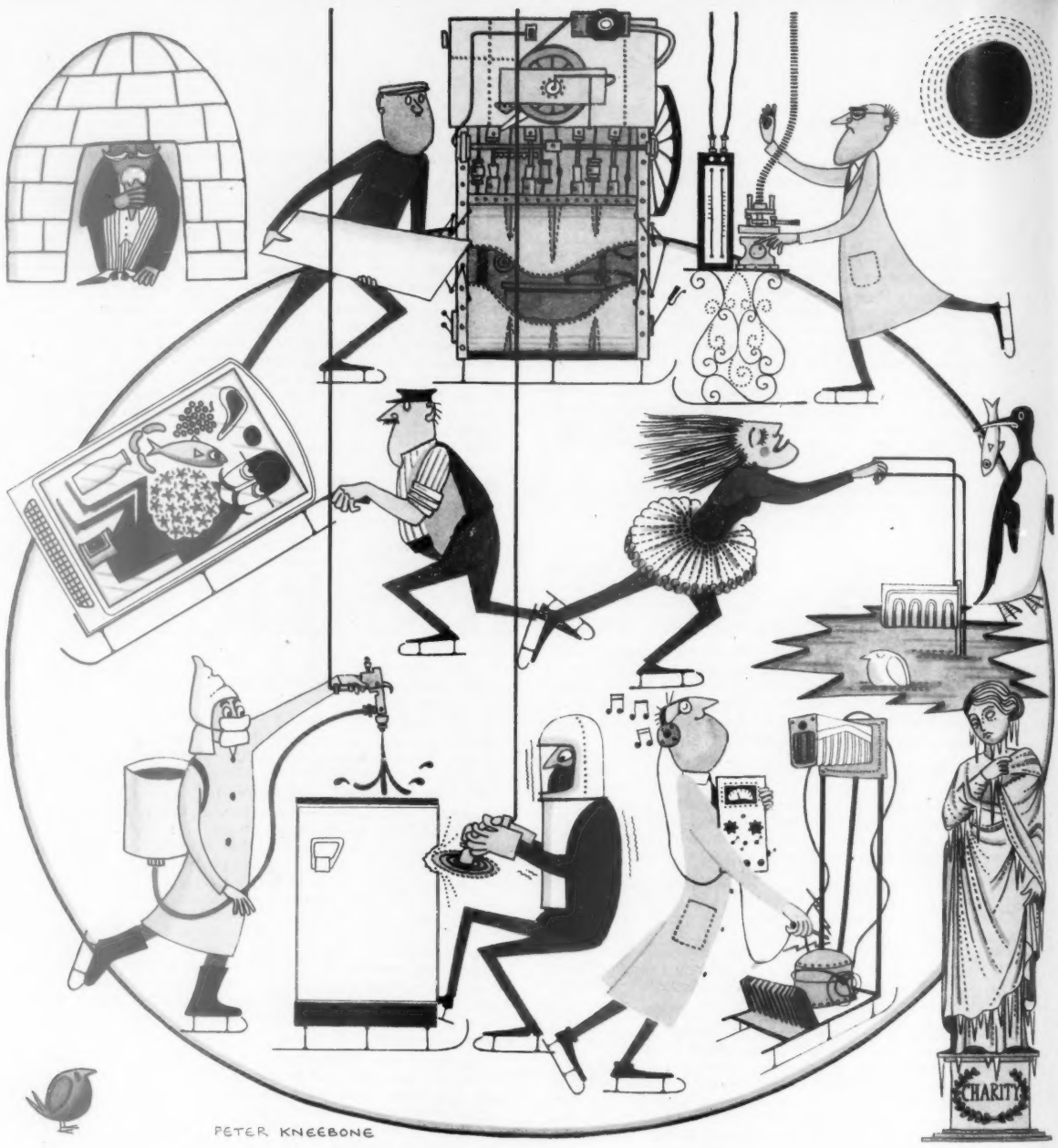
Early in 1893 Mr. Weisel retired and the stockholders passed a resolution changing the company's name to The Vilter Manufacturing Company. Theodore O. Vilter became president, William C. Vilter, secretary, and Emil Vilter was made plant superintendent.

Prior to 1890 the refrigeration industry in general was not very prosperous as the applications for refrigeration were few. In that year, however, there was an almost complete failure of the natural ice crop, and the public was awakened to the possibility of manufactured ice. The demand for equipment grew at a terrific pace and soon Vilter was producing horizontal double acting compressors in sizes of from 6 in. × 12 in. to 21 in. × 42 in., the units being arranged for direct Corliss engine drive. Duplex units with cross compound condensing engines were also built and shipments were made in amazingly short periods of from 60 to 90 days. Many of those who purchased Vilter equipment at that time are still in active business today, remaining Vilter customers.

Realizing the requirements and demands of various industrial fields covered by its products, Vilter developed the raw water plate ice plant and has the distinction of installing more of these ice plants than all of its competitors combined. In addition to the plate plant, raw water can ice plants came into prominence. Here Vilter promoted the use of the flooded coil system to obtain higher economies in ice manufacture.

The year 1910 marks the installation of the first pre-cooling plant for the Santa Fe railroad at San Bernadino, California. This ice-making pre-cooling plant was designed by Vilter to produce 225 tons of ice and to chill 150 carloads of fruit per day. Cars were spotted along an extensive loading dock equipped with large air ducts permitting circulation of 6 to 8,000 c.ft. of chilled air per minute per car. With this installation the cars and contents could be chilled after which they were iced to maintain the low temperatures.

In the early 1900's there again arose a demand for a more



Oiling the wheels of industry—

REFRIGERATORS

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economical steam engine. As a result Vilter developed and put into production a poppet valve engine which increased economies of 10 to 15 per cent. over those obtained with a Corliss engine.

At about this time, Vilter furnished the equipment for one of the first air-conditioning installations in Milwaukee—the old Badger Room in the Wisconsin Hotel. Since then, Vilter has progressed with the industry and many prominent air-conditioning plants in all parts of the country are of Vilter design and installation. Vilter installed the first unit cooler in a small butcher shop in Milwaukee and in this way made an outstanding contribution to the refrigeration industry.

Until 1930, room temperatures below –10°F. were unheard of ; however, quick freezing was a topic of much discussion. Being one of several manufacturers to receive specification on a 22,000 c. ft. room to be reduced to –50 for freezing meats, Vilter worked out a system to do the job. This plant became another outstanding Vilter installation and is still in operation.

With the availability of " Freon-12 " for use in refrigerating systems, Vilter at first utilized the standard vertical ammonia compressor but shortly thereafter designed and tested a new line of vertical units adapted for use with the new refrigerant. They were, of course, fitted with rotary seals to minimize any loss of this odourless expensive refrigerant. The " Freon " compressor line was also adopted for use as boosters in two-stage compression systems.

In 1932 Vilter placed its world famous Pakicer on the market. It was one of the first self-contained ice makers ever built. It produced a crystal form or briquetted ice which was, and still is, very much in demand. This unit proved to be one of the most efficient and trouble-free means of manufacturing ice in a form in which it can be used immediately. Vilter Pakice equipment is built in vertical or horizontal designs and in capacities of from one to 30 tons per 24 hours per unit.

During World Wars I and II Vilter supplied much of the badly needed refrigeration equipment for the American Expeditionary Forces. However, in addition to the refrigeration equipment built during the World War II period, 105 MM howitzers and 3 in. anti-tank guns were manufactured. A new shop was fully equipped with modern tools and Vilter gained recognition for its low cost production record of howitzers and other ordnance material. Incidentally, many hundreds of the Pakicers produced for the Navy during the last year are still in operation throughout the world.

One of the most recent of Vilter's developments is the Vilter multicylinder compressor manufactured in 2, 4, 6, 8, 12, and 16 cylinder sizes. Available for the various " Freons " or ammonia, booster or high pressure operation, these statically and dynamically balanced units, operating at fairly high speeds, require minimum foundations and provide refrigeration at the lowest cost per ton.

Other new developments include a new line of Vilter VXF and VSC evaporative condensers. The VXF models have an externally mounted fan. The capacities of these units range from 30 to 300 tons. Vilter also has put packaged liquid chilling units called the Uni-Chiller on the market. This unit is a popular item in air-conditioning installations. The company has also put out a packaged liquid transfer unit which is finding favour in those installations where a liquid return to the compressor is a problem.

Many other new products and improvements on various existing designs are in various stages of development and will be available for the open market as soon as they have been proven in tests and in the field.

France

THE PICTET COMPANY

THE Pictet Company is one of the oldest refrigeration firms in Europe. From 1860 onwards, Monsieur Raoul Pictet set about exploiting commercially in Geneva his many patents and it was there that he founded the " Société Genevoise pour la Construction d'Instruments de Physique et de Mecanique."

From 1875, the Société Genevoise installed in many parts of the world compressors working on sulphurous acid.

The French market offered many interesting outlets and in 1875 also Monsieur Pictet established in Paris the " Société Anonyme des Brevets Raoul Pictet et Cie." He

Pictet's exhibit at the universal exhibition in Paris in 1878 included a 24-ton/day ice-making plant.

showed at the universal exhibition in that city in 1878 and in a special pavilion displayed a plant for manufacturing 24 tons of ice a day.

In 1880, the company took the name of " Cie Industrielle des Procédés Raoul Pictet " and from this date concerned itself with the production of refrigeration plant of every kind.

In latter years an outstanding development has been the manufacture of a four-cylinder V-type machine which makes

possible installations up to 15,000 frig./hr. with methyl chloride and up to 30,000 frig./hr. with ammonia.

In 1952, the Pictet Company took up a licence for the manufacture rights in France of hermetically sealed compressors of the British Lec Refrigeration Ltd.'s design.

With a range of plant from 200 to 30,000 frig./hr., the Pictet Company can meet most of the refrigeration needs found in the vastly expanded market of the last few years.

At this year's Brussels Exhibition, the company is displaying a standard automatic plant for liquid cooling with cold accumulation based on an entirely new system.

Belgium

S. A. ATELIERS LEBRUN

IN 1868, exactly 30 years before the birth of the journal well known among all refrigerationists in the world, MODERN REFRIGERATION, the Belgian engineer, Monsieur Bruno Lebrun, started his factories at Nimy. Less than 20 years after that, namely on January 10, 1887, Monsieur Lebrun designed his first compressor for ice making which he called " pompe ammoniac a double effet, de 0·15 m. d'alésage × 0 m 20 de course tournant a 30 tours/minute " !

In the year of the birth of MODERN REFRIGERATION, Lebrun constructed his " flat twin " compressor-type BL, which was the first compressor in the world with a rotary seal. This type has been installed not only in Belgium but in France, Holland, Spain, Italy and Greece.

Development continued down the years and large v-type machines were produced working with six-stage compression. A very large and important installation was undertaken in 1920 when the Refribel store at Antwerp, of 45,000 m³ capacity, was equipped with Lebrun plant. An even larger plant was put in at the Gdynia refrigerated depot in Poland in 1930, this being of 63,000 m³ capacity. In 1932, the company built, for the Glacieres de l'Alimentation in Paris, a double-effect, compound, horizontal machine of 2,000,000 frig./hr.

In all branches of the food trades, installations have been made, as, indeed, they have been in the merchant marine.

Air-conditioning has formed an important part of the business, particularly in the Belgian Congo market. Mines have been air-conditioned to a depth of 1,200 metres.

A spectacular display will be seen at the Brussels Exposition where in one of the " bipods " of the famous " Atomium " will be three installations of our eight-cylinder ME compressors for air-conditioning the lower spherical structures.

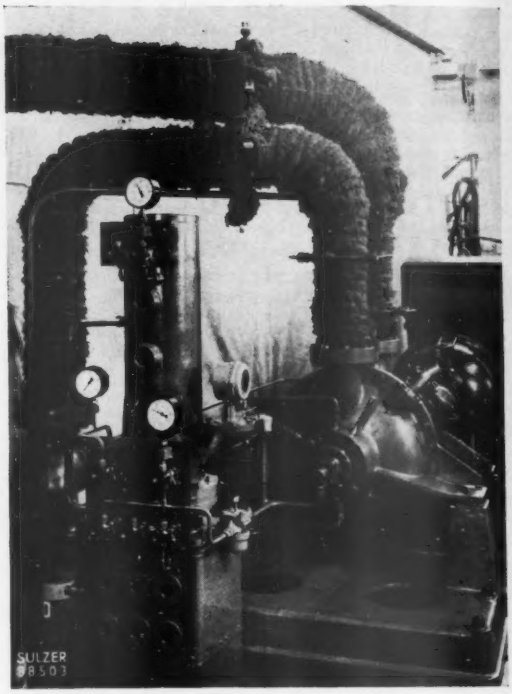
Switzerland

SULZER BROTHERS LTD.

THE manufacture of refrigerating machinery was taken up by Sulzer Brothers 80 years ago. The first four ammonia compressors were supplied in 1878 to a Swiss dairy and to two ice-making plants in India.

Sixty years ago, in 1898, the production of refrigerating machinery had already made great strides. In that year 28 ammonia compressors with a total capacity of 4,000,000 B.t.u. per hour were supplied to breweries, abattoirs, ice plants and other users in many parts of the world.

The first compressors were of horizontal design (fig. 2). They ran at a speed of only 100 to 180 r.p.m., which meant that they were of comparatively large dimensions. To attain higher capacities with the same space requirements it was necessary to raise the speed, and for this reason " fast-running " compressors were next designed. These ran at speeds up to 230 r.p.m., but were still of the horizontal type. A substantial reduction in space requirements became possible only when the first vertical compressors were introduced. Even then, the horizontal design had to be retained for very high refrigerating capacities, as the units would otherwise have been too high.



"Freon" turbo-compressor intended for an air conditioning installation; refrigerating capacity 2,400,000 B.t.u. per hr.

An important step in the development of Sulzer refrigerating machinery was taken with the introduction of fast-running two-stage compressors of vertical design known as the CV range. These run at speeds up to 730 r.p.m. and have given excellent service up to the present day. As they have two stages, these compressors are suitable either for tropical conditions or for low evaporating temperatures.

In recent times, and particularly during the last war, numbers of heat-pump plants have been installed to permit heat to be generated even when fuels are in short supply. The two-stage CV compressors are extremely well suited to this duty. When the final temperature is very high, a special compressor is used for the last pressure stage.

In all conventional types of reciprocating compressors, some oil enters the refrigerant circuit, with the result that heat transmission is impaired both in the condenser and in the evaporator. To surmount this difficulty, the oil-free refrigerating compressor was developed. The cylinder of this unit requires no lubrication, as labyrinth sealing is employed instead of piston rings and the piston therefore moves freely without touching the cylinder walls.

The growing demand for air-conditioning installations has led to the development of high-duty space-saving " Freon " compressors. The Sulzer " Freon " turbo-compressor

The most important feature of 'Kynal' Roll-welded Sheets is their superior heat transfer efficiency, assured by passageways which are *integral with the sheet*.

THERE ARE OTHER NOTABLE ADVANTAGES:

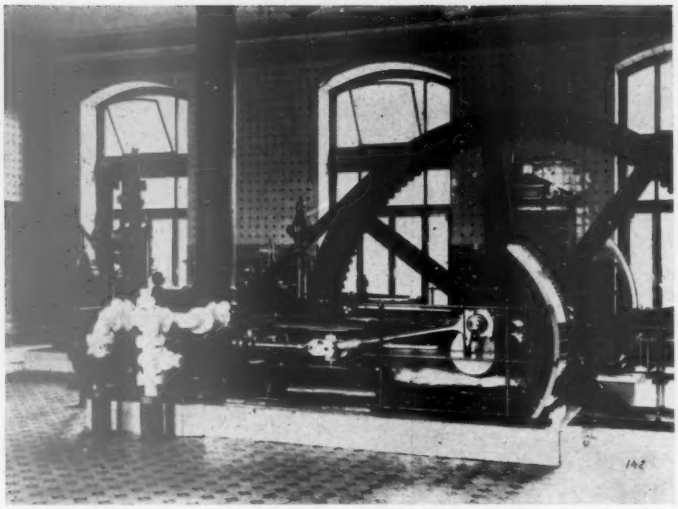
- any desired pattern of passageways can be produced
- the sheets may be bent without buckling the passageways
- the passageways are perfectly clean and free from contaminants
- a wide range of forms and surface finishes readily available

No wonder engineers with heat transfer problems are more than interested

'KYNAL' roll-welded heat transfer sheets

IMPERIAL CHEMICAL INDUSTRIES LIMITED, LONDON, S.W.I

KL.1



Horizontal ammonia compressor running at about 100 revs. per min., supplied in 1899 to a brewery in Zürich.

(fig. 1) runs at high speed and is very modest in its space requirements.

The trend in refrigeration engineering to-day is towards lower temperatures and more compact machines offering a higher capacity per unit weight. Where high refrigerating capacities are concerned, there is therefore every reason to believe that a wide field of application awaits the modern high-speed turbo-compressor.

The Insulation Field

Great Britain

CORK GROWERS TRADING CO. (1931) LTD.

For 40 years, the Cork Growers Trading Co. (1931) Ltd., have been in the forefront of the supply and manufacture of cork for the insulation field.

There have been many changes in the manufacture of this material since they first started in 1919, but by reason of the fact that they were always able to supply first-class material, their business has continued to increase. They have been associated with the Reliable Cork Company S.A., of Cassa de la Selva, and Sociede Portuguesa Aglomerada de Cortica Lda. of Lisbon, for a long period of years, and by this association are able to supply both oven-baked and steam-baked corkboard. It is well-known many people prefer oven-baked and others the steam-baked material, but by being able to supply both types, from their associated factories, are always able to offer their customers a choice.

In addition to the corkboard of normal densities, they supply the heavier densities such as 10/12, 12/14, 16/18 and 18/21 lb. per c.ft., and by being able to do this they cover practically every field in which corkboard is used.

They keep large stocks at Liverpool, London, Glasgow and Dublin, in all sizes and thicknesses. Further, in addition to being able to supply all the standard sizes, they manufacture to special sizes and shapes, according to customers' specifications.

Again, the methods of manufacture of pipe cork covering have changed considerably during the period of 40 years, as they were exceptionally crude in the early days. Now, however, they, as in the case of corkboard, have continued to progress and are able to offer cork pipe covering which is moulded by the most modern methods. At one time it was impossible to supply pipe covering which had an outside diameter greater than 8 in., without having a series of bitumen joints, but on account of the progress which they have made, Cork Growers now mould all their pipe covering and thus the material can be manufactured up to a diameter of 30 in. or even greater, if necessary, without any bitumen joints. Moreover, large pipe covering, at one time, could not be supplied in lengths greater than 18 in., but now they can manufacture in 36 in. lengths.

In addition to the straight pipe covering, all the necessary fittings, such as flange boxes, tees, elbows, valve boxes, etc. are manufactured to customers' drawings.

The company has made a specialty of cork segments, cork lags and slotted corkboard : and as in the case of cork pipe covering, cork segments could only be supplied in 18 in. lengths, but due to improved technique, they are now able to make them in 36 in. lengths, and 12 in. widths, thus saving labour for the insulation contractor and improving efficiency by reducing joints to the absolute minimum.

In addition to importing some granulated and re-granulated cork : from their associated factories abroad, Cork Growers have a plant at Bootle which produces some special grades, and they are able to furnish practically any type of granulated or re-granulated cork required in this country.

Cork Growers felt it was possible that the building and allied industries might become interested in a plastic insulation of a cheaper nature than cork and they decided to put a plant down to manufacture polystyrene insulation. They are, therefore, in a position to give a similar service in pipe covering and fittings manufactured in polystyrene from their plant at Bootle. They are not certain whether polystyrene will ever take the place of cork insulation products, but they are in a position to give a service in keeping with that offered over the last 38 years for cork.

MOULDED IN LUSTREX

Refrigerator butter dishes moulded in Lustrex by Fraser & Glass Limited for the Pressed Steel Company Limited

Lustrex polystyrene has grades for every purpose: *for toughness*—and extra-toughness . . . Lustrex Toughened 3 and Toughened 11 • *for vacuum-forming*—Lustrex Toughened 6 for sheet extrusion • *for intricate mouldings*—especially those needing a long flow . . . Lustrex Hi-Flow 55 • *for dry colouring*—to any shade you require . . . Lustrex Colourant Blend • *for almost any job in polystyrene* . . . Lustrex General Purpose. *Lustrex is a Registered Trade Mark.*

We also welcome your enquiries for the following imported product which is manufactured by Monsanto Chemical Company, U.S.A.

Santocel A for Thermal Insulation.

1. *High Thermal Efficiency*—K Factor (mean temp. 60 F.) 0.150 BTU/Hr./ft.²/in./ F.
2. *Free Flowing Properties*—simplifies the filling of irregular spaces.
3. *Versatile*—saves space and is ideal for both high and low temperature work.

MONSANTO

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EXPANDED RUBBER COMPANY LIMITED

WHEN MODERN REFRIGERATION AND AIR CONTROL was established in 1898, Onazote expanded ebonite for thermal insulation had not even been thought of. When it was finally produced in Great Britain, this journal, which celebrates its diamond jubilee this year, had already been in being for 21 years.

Last year the Expanded Rubber Company Limited celebrated its 21st anniversary, but Onazote had already been made in Great Britain in a small way by C. L. Marshall in 1921. It had a small beginning at 38, Harlesden Road, Willesden, and a somewhat chequered career until 1936 when the present company was established. The company has grown steadily since that time and is now the largest in the world solely engaged in cellular polymer production. Of these Onazote expanded ebonite is still the most important product, and its use as a thermal insulating material is still unrivalled.

Regarding its general properties, the two most significant factors are the low thermal conductivity of only 0·2 B.t.u./sq. ft. hour. in./°F. and its low water vapour transmission of only 1·58 grains/sq. ft./24 hours for 2 in. thickness, when tested at 100°F. (38° C.) and 1—90 per cent. relative humidity gradient.

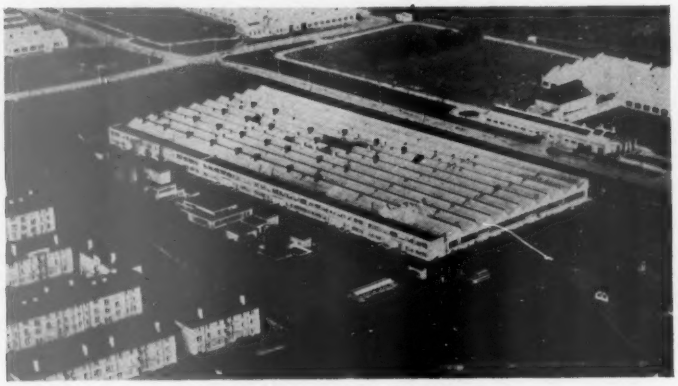
This combination of properties is not found in any other product, and it is for this reason that Onazote has been so much sought after as the ideal insulating material. A special feature is its homogeneous structure of completely closed cells, without relying on the sintering of granules to obtain the required strength and thermal properties, which is the case with certain other materials.

Many physical and mechanical tests have been applied to Onazote in order to study its performance over a wide temperature range, but space does not permit to deal with such details ; in any case they have been published elsewhere.

Only recently Onazote panels were removed from an insulated structure into which they had been fitted 25 years ago. It was free from any water and its thermal conductivity when tested was of the same order as the figures quoted.

This inertness and stability of Onazote is typical of that of an ebonite structure which is the basis of Onazote. The author has samples in his possession made in 1915, which show no deterioration whatever in either appearance or mechanical properties. Ice-cream boxes insulated in 1925 have had to be returned for repair, but the Onazote, as good as the day it was fitted, was re-used, and is still in use. A British Railway container inspected in 1950 was an Onazote insulated " F" type railway meat container constructed in 1930. Even after 20 years of active service the same Onazote which was dry and perfectly intact, was refitted, and is still in use.

Onazote is manufactured at both E.R.C. factories, one in Croydon, the other in Dundee. An aerial view of the latter is shown in the illustration.



Aerial view of the Dundee factory.

At the present time Onazote is being used in all industrial countries of the world, and for some years now Expanded Rubber Company Limited have found it necessary to cater for contracting work through its subsidiary company, Onazote Insulation Company Limited, which has a wide experience in cold store insulation, and general insulation contracting, specialising in low temperature applications.

There is an ever-increasing demand for Onazote for ever-widening fields of applications, including cold store insulation, refrigerated transport for road and rail services, transport containers, ship's insulation, industrial plant and pipe sections, to mention but a few.

GREGSON & CO. LTD.

SIXTY years ago—those were the days—marine insulation was still in its infancy, although the carriage of dairy produce had been going on for 20 years. In 1881 the first shipment of frozen meat left New Zealand for Britain in the sailing vessel *Dunedin*, its value £8,000 ; to-day, the value of frozen produce from New Zealand alone is in the region of £70,000,000 annually.

Insulation of the spaces to be cooled was carried out in those days with timber grounds fixed with tongued and grooved timber linings and the space between filled with charcoal, and in some cases, sawdust. Later, of course, granulated cork came into its own and to-day is one of the foremost insulating mediums.

The cooling of course was effected by the use of grids throughout the spaces, fed by leads running from the machinery room through the coal bunkers, and what a dirty job it was when repairs were necessary to these particular leads.

There were no lights available as we know them, to-day, and men worked in such spaces with the aid of tallow candles clambering over the heaps of coal or coaldust, and it leaves little to the imagination to realize what these workmen looked like at the end of a day's work.

How different it is to-day, with oil-burning ships, electric light, and no coal bunkers to worry about.

The method of insulation remained the same until the middle of the 1920s except that charcoal as an insulating medium had ceased to be used. About 1925 fans were

brought into use to increase the efficiency of cooling, and special fan houses were built, usually in the upper 'tween decks with air trunks leading down into the lower spaces. The grids lining the shipsides in the 'tween decks were faced or enclosed by deck-to-deck, or floor-to-ceiling linings, or screens, forming a trunk in which was cut a number of holes along the whole length of each side. The air from the fan was directed along and over the grids on one side of the ship, through the holes in the screens, and across to the other side where it was sucked back to the fan and redelivered.

This method so improved the efficiency that it is still used to-day, but generally in a more advanced design.

The modern refrigerated ship is literally a veritable rabbit warren so far as insulation is concerned due to the concealed air ducts. Grids as such are no longer used, but are formed as a battery in one single unit enclosed within a casing through which the air is passed by highly efficient fans. The system most common to-day creates much more specialized work on the part of the insulation contractor whose duty it is to build and install all the intricate battery houses and ducting, 60 per cent. of which is buried in the insulation and is not visible to the naked eye except for the small delivery openings, usually on the deckhead or overhead, and which pass through the coamings forming the loading hatch perimeter. This is often as much as 35 ft. by 20 ft. in area which, when closed, consists of insulated beams with bevelled sides to which insulated plugs are fitted. The air is returned via suction ducts whose openings are at floor level.

The introduction of the air-circulation system had further hazards as far as insulation linings were concerned inasmuch as the drying effect of the forced-air circulation dried out the natural moisture in the timber linings during the cooling and freezing periods, which in turn became saturated with moisture during the off periods when the ship was unloaded, and due to the high humidity conditions prevailing. This in turn had a very detrimental effect on the timber, causing dry and wet rot, and culminating in heavy repair bills. This all became evident just prior to the late world war, and due partly to these phenomena and the shortage of timber due to the war, metal linings were introduced and adopted, with a certain amount of success. However, due to the fixing arrangements on board ship, where the superstructure is of steel, difficulties were experienced in insulating the inner linings from the shell, or ship's structure, and exceptional heat leakages prevailed. Also the linings now required to be absolutely airtight because with air circulation it was necessary to prevent the circulating air at a temperature of 0° from entering the insulation and becoming, due to its induction of moisture, a mass of ice. It was also very important when the linings, etc., were of a portable nature, as is often necessary, to remove certain sections of the linings for the examination of the main structure, and so far as Lloyd's are concerned this is necessary at least every five years.

The practical difficulties of securing linings, and so obtaining the above advantages were overcome largely by the development by Gregson & Co. Ltd. of their patented " Insurail " system, which consists of completely insulating and separating the internal linings within the room, or space, from the outer structure, thus obtaining maximum thermal efficiency from the insulating material. By this method the lining, which can be of any non-porous material of sheet form, such as aluminium, galvanized steel, plywood, asbestos or similar materials, is made air- and watertight. The system admits if necessary, particularly in the case of ships, for the linings to be removed at any time for the examination of the structure behind the insulation, and subsequently can be refitted in its entirety, using the same materials. This system is the accepted standard to-day, and is used throughout the world wherever ships are built, from Canada to China, from Norway to Portugal.

F. McNEILL & CO. LTD.

IT is reported that mineral wool was first produced in 1840 in Wales, when the process involved fiberizing a stream of molten slag issuing from an iron blast-furnace with a jet of steam. Little further progress was made until the closing years of the 19th century, when the first cupola was erected in Germany for the melting of solid blast-furnace slags, enabling some degree of control to be exercised over the chemical composition and physical characteristics of the fibres.

F. McNeill & Co. Ltd. commenced manufacture of their Slagbestos mineral wool at the end of the last century at a plant in Kirkintilloch, a small town some eight miles from the centre of Glasgow. At this time the output was limited solely to the loose wool, packaged in hessian bags and shipped to customers, who either employed it as received to fi- cavities arranged around equipment, or fabricated it themll selves into a crude form of mattress with which to insulate such vessels as boilers, tanks, etc. There was, too, an interest being shown in the use of mineral wool as thermal insulation in dwellings, but it was to be many years before this latter field was fully recognized.

The plant necessary to produce the requirements of customers at this stage was remarkably simple. A brick-lined cupola, hand-charged with slag, rock and coke, provided a molten stream which was fiberized by a jet of steam supplied by a small boiler ; the fibres were blown into a room, known as a blowing chamber, and collected by hand and packed in bags.

It was not long, however, before the demand for this efficient fireproof thermal and acoustic insulation material made necessary an increase in output, and this was initially met by installing a greater number of larger cupolas, and arranging the floor of each blowing chamber as an endless belt conveyor on which the wool could be carried to a packaging station.

By this time the range of products available from McNeill's mineral wool plant was widened to include an efficient form of mattress, comprising a " sandwich " of mineral wool, in thicknesses from 1 in. to 4 in. as required, between sheets of galvanized wire-netting. These met with immediate approval of the customer concerned with the insulation of large vessels and plant, significantly reducing his labour cost, and, due to the factory-controlled density of the wool in the mattress, greatly increasing the insulation efficiency, making possible lesser thicknesses which, in its turn, again lowered the cost of the installation.

By 1930 another form of Slagbestos mineral wool was well established, and was the means by which it became possible to meet the awakening demand for the thermal and sound insulation of houses and flats which, ever since, has continued to grow year by year. This product, consisting of mineral wool sewn between sheets of strong paper, became known as Slagbestos mineral wool blankets ; these were supplied in easily handled rolls which could be easily laid over floor or ceiling joists.

Soon, further improvements in manufacturing efficiency and product quality were sought, and hand-charged brick-lined cupolas gave way to high-capacity, water-jacketed units, mechanically charged ; blowing chambers and conveyor systems were refined so that, by the addition of adhesive binders to the fibres as they were blown, resilient, flexible felted products of predetermined density, thickness and size could be made. These, known as Slagbestos felted slabs, rapidly found a wide market as thermal insulation in all types of equipment, such as refrigerators, cookers, ovens, furnaces, boilers, etc., and as sound-absorbents in film studios, cinemas and offices. At this time, too, the wool fibres were treated to provide water-repellency so that low-temperature installations, where the effects of moisture place severe demands upon the insulation, could be satisfactorily designed.

Then, with the need to meet and surpass the ever more stringent specifications imposed by customers upon insulation products, came the replacement of the earlier types of binders by synthetic-resins, increasing the strength and resilience of the felts and making larger sizes possible.

Finally, the most recent developments have led to the installation of an entirely new process of fibre production. In this, no longer are the molten contents of the cupola blown by steam ; instead McNeill's have now adopted the latest American method of producing long silken fibres by the spinning process. The result—Slagbestos spun mineral wool now forms the basis of McNeill's insulating products, increasing strength and resilience, reducing density and possessing even higher efficiencies.

To-day F. McNeill & Co. Ltd. are producing loose spun Slagbestos mineral wool ; Slagbestos mineral wool blanket in waterproof paper covering ; Slagbestos mineral wool resin bonded felted slabs ; Slagbestos mineral wool wire netted mattresses, and a full range of Slagbestos wraps for cisterns and cylinders.

NEWALLS INSULATION CO. LTD.

THE demand for the thermal insulating materials manufactured by Newalls Insulation Co. Ltd. has remained exceptionally high during the past few years in both the high and low temperature fields. While a comprehensive range of products is employed, the largest tonnage consumed in the respective temperature groupings has been in " Newtempheit " for high temperature work, 85 per cent. magnesia and asbestos for medium temperatures, and for low temperature " Nonpareil " corkboard continues to be the material most widely used.

The plant capacity for the manufacture of these commodities in their factories has been greatly extended during the past five years, not only to cope with the demand in the home market but to meet the needs of the large number of contracts being carried out abroad. Newalls Insulation Co. Ltd. maintain resident insulation staffs in various parts of Great Britain and in most countries abroad.

The fact that " Nonpareil " corkboard continues to be used in considerable quantities is not surprising in view of its many admirable qualities and the fact that it has long been proved to be both durable and efficient when properly applied and adequately protected.

One factor common to both heat and cold insulation is the use of bigger thicknesses today as compared with a few years ago. This is one of the more significant trends in modern thermal insulation practice. It arises partly from the higher price of fuel—this in itself a reason for conserving fuel—and partly from the more stringent technical requirements of the times. Higher temperatures are encountered in general engineering practice and lower temperatures in refrigeration and cold storage. Both require bigger thicknesses of heat insulation. Apart from this, however, the standards of insulation have been elevated in the sense that a higher technical performance is generally required. An inadequate thickness of insulation, besides being wasteful economically, has its weaknesses clearly demonstrated as the temperature range of industrial processes widens. This may occur with some of the very low temperatures in refrigeration or at the other end of the scale in the higher superheated steam temperatures in use today.

In general, then, a large proportion of thermal insulation contracts now require nearly twice the thickness they needed a few years ago. A typical example is the lower temperature encountered in the insulated holds of ships. More careful construction is now required in the vicinity of beams and in the supporting connections from the ship's structure generally.

A high level of output has been maintained by Newalls Insulation Co.'s contracting organization over the past few years, both in land and marine work, and some types of cold insulation contracts for which the demand has been brisk are referred to below :—

Factories and similar buildings normally use 1 in. to 2 in. of cork protected by either cement or emulsified asphalt on air-conditioning equipment.

The majority of passenger cargo liners for the Atlantic and far-eastern trade have their public rooms and parts of the accommodation insulated with corkboard to assist in maintaining the temperature at a suitable level. The cork applied to air-conditioning contracts on ships is usually finished with a special cement, particularly suitable for marine purposes, which presents a pleasing surface and which is able satisfactorily to withstand the conditions peculiar to ship use.

Insulated tunnels for the quick-freezing of ice cream are employing thicknesses of cork as high as 12 in. for the low temperatures involved which are of the order of minus 40°F.

The petroleum and chemical industries have constructed several new plants which require a considerable amount of low temperature insulation. Newalls Insulation Co. Ltd. have carried out some considerable contracts in this sphere in which optimum temperature control is of great importance and the design and fitting of the insulation requires particular care and planning. Where the total length of insulated pipework is so considerable, as also is the area of the vessels involved, it is necessary to give consideration during erection to methods of maintenance so that a minimum future expenditure is necessary.

Brewery tank rooms, beer vats and associated brine pipes and chilled water pipes ; about 6 in. of cork is normally employed for tank rooms with a finish of cement. In the same industry the bulk storage of CO_2 involves thicknesses of 9 in. of corkboard on the appropriate tanks.

The food production industries have also been active, particularly with storage rooms for dairies employing about 4 in. of cork together with cheese rooms and quick freezing stores of various types using up to about 12 in. of corkboard.

Numbers of road tankers for the transport of a variety of products have been dealt with. For these, cork is generally used for the lower temperatures and Newall's 85 per cent. magnesia in plastic and slab form for the conveyance of hot liquids.

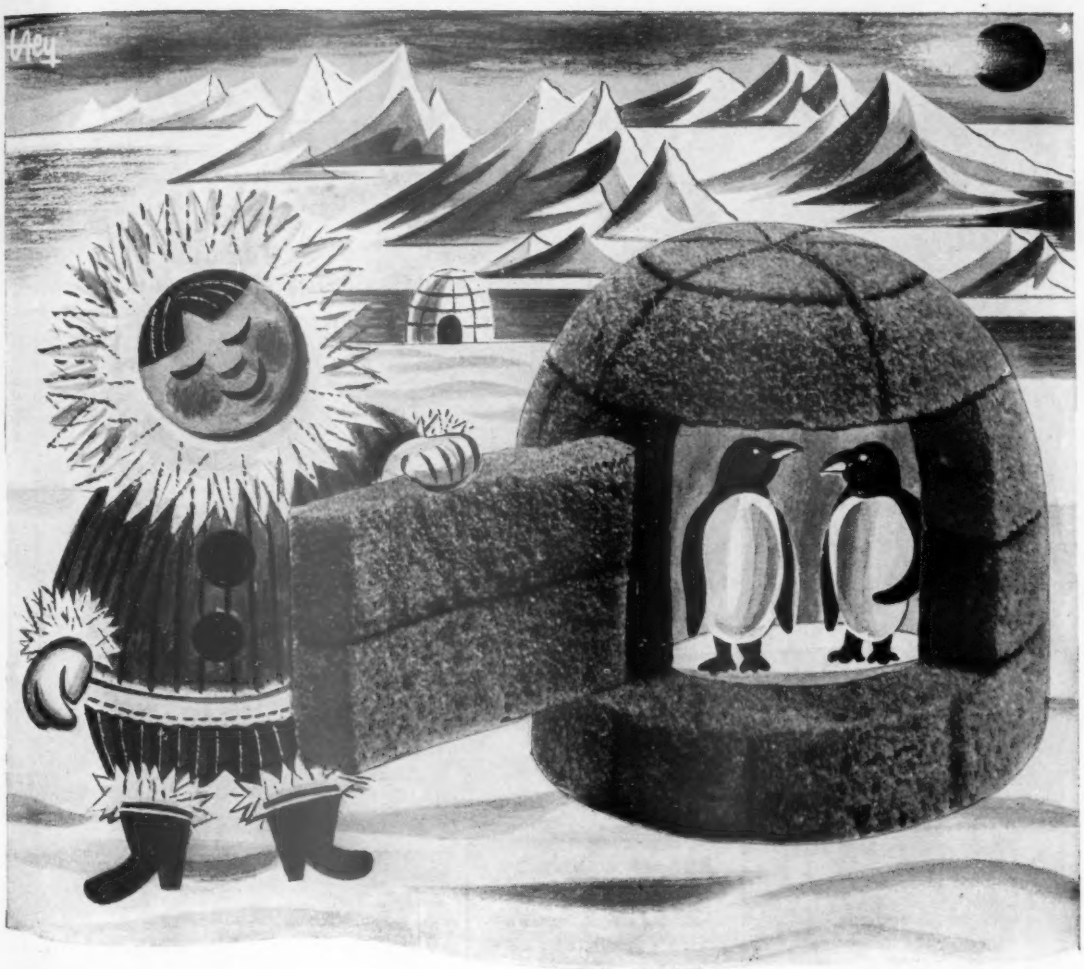
SMITHS INSULATIONS LIMITED

FROM extreme heat to sub-zero temperatures—this contrast has marked the 84 years' progress of a firm now famous in the design and construction of some of Britain's largest cold stores.

When they began operations in 1874, Smiths Insulations Ltd., of Burton-on-Trent, (then T. Smith & Co.), were more concerned with the retention of heat than its exclusion and they built up a widely spread service in boiler and pipe covering.

A review of industry published in 1896 had this to say :—

> "In these rushing days of acute competition, economic details even of the most apparently trivial character receive most careful consideration. A great difficulty, which has had to be faced by steam-users everywhere, has been to prevent the waste of fuel and loss of energy arising from radiation of heat from exposed steam surfaces. From time to time numerous boiler coverings of non-conducting compositions have been put on the market, with more or less success, and several firms have achieved a high reputation for producing really reliable and durable compositions. The largest and most reputed firm in the Midlands engaged in this particular industry is that of T. Smith & Co., of Burton-on-Trent, who are very extensive manufacturers of non-conductive, heat-retaining, and self-adhesive composition for covering boilers, steam pipes, tanks and cylinders. Originally starting in 1874 as makers of



new insulation, light and strong

These simple-to-mix components give rigid foams to provide the refrigeration industry with a remarkable new insulating material that combines high thermal resistance with strength and lightness. Easily mixed on the site, the components produce the foam in the cavity to be filled. Foams of varying density can easily be made.

with Isocyanates and POLYESTERS by ICI

Ask for details of **Daltolacs 21 & 22** and **Suprasec D**

Enquiries should be addressed to:
I.C.I. Sales Development Department (Polyisocyanates), Ship Canal House, King Street, Manchester 2.

IMPERIAL CHEMICAL INDUSTRIES LIMITED LONDON SW1 ENGLAND D965

Frozen Stiff ?

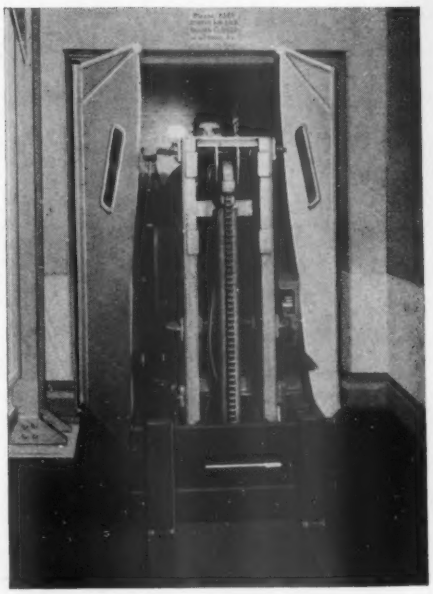
not Neway Flexible Doors

Neway Doors give efficient service in all temperatures down to −35° F. Flexible doors are used in cold storage rooms to prevent warm air entering through the opening and condensing on the cooling pipes. The doors are invariably fitted immediately inside the insulated door, which can then be left open during the loading or unloading of the cold room without fear of the temperature of the cold room rising unduly. Neway doors are safe. The rubber panels, which are specially designed for the doors by the Dunlop Rubber Co., are flexible and yet close tight enough to seal out draughts and noise. When fitted there is no fear of crushed fingers or other accidents. Easily installed in existing frames they can be made to fit any size opening. Once fitted little or no maintenance is ever needed. Neway Doors have already been fitted in the cold storage rooms of many leading firms, including J. Lyons & Co. Ltd., and Birds Eye Foods Ltd.

Rubber panels by
DUNLOP
Rubber Co., Ltd.

See Neway Flexible Rubber Doors at the Building Centre, 26 Store Street, London, W.C.1, or write for free leaflet to William Newman & Sons Ltd., Dept. RI 9, Hospital Street, Birmingham 19.

NEWAY
Rubber Doors



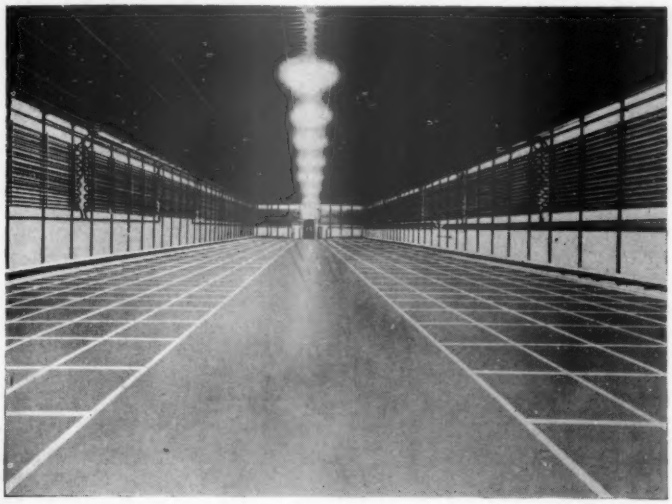
By courtesy of J. Lyons & Co. Ltd.

WILLIAM NEWMAN & SONS LTD., Dept. RI 9, Hospital Street, Birmingham, 19

ordinary covering composition as made already by a score of firms, they soon made their mark by introducing their patent " perfect " felted covering composition, which has had an enormous sale all over the kingdom, with a daily increasing demand. Heavy contracts have been filled for H.M.'s Government, the leading engineers, railways, corporations, and noblemen throughout the kingdom, from whom over 3,000 strong testimonials have been received."

scale operation occurred two years ago when Smiths Insulations Ltd. undertook the construction of what was then the largest chamber on this side of the Atlantic at Great Yarmouth in Norfolk. This large store provided a clear storage space of 250,000 c.ft., with a capacity to hold 2,500 tons of quick frozen foods. The whole job was completed in the record time of 24 weeks. Since then, an extension has more than doubled its capacity.

Smith's Insulations Ltd. is now working on a much



A recent example of large cold store construction by Smiths Insulation Ltd. — the Birds Eye store at Great Yarmouth.

It followed naturally when cold storage developed that the technique of insulation for heat could also be applied conversely for cold, and their early activities at the " bottom end of the thermometer " were largely devoted to beer conditioning plants and brewery bottling stores.

In the " Metropolis of Brewing " and in the modernization of breweries, the company made rapid progress and their operations extended far and wide, including the insulation of breweries in Malta and Africa.

At the same time, Smiths enlarged their scope by exploring new avenues in the manufacture of small, medium and large sectional cold storage cabinets, and in the development of complete cold stores for industries concerned with ice-cream, dairies, meat, fish, fruit and food generally.

The evolution of deep-freeze opened up vast new possibilities. Fresh food all the year round became enormously popular and called for the establishment of immense cold storage buildings and distribution depots to meet the heavy demand from the public.

Conventional methods of building these stores would have taken far too long, and building operations would have been subject to a temperamental climate, involving many delays. Speed in construction was absolutely essential.

Smiths Insulations Ltd. rose nobly to the occasion and introduced their now famous technique in the pre-fabrication of structural units. These units are made up in their factory, delivered and quickly assembled by bolting together on site.

A great advantage of this method is that the work of construction can proceed irrespective of the weather, and as building time is shorter, the cost is correspondingly less.

A striking example of the value of this method in large

larger contract to provide low temperature store with a capacity of nearly 1,000,000 c.ft. Simultaneously, other contracts are in hand for another store of 600,000 c.ft. at Lowestoft, and many cold stores for the fishing industry in Hull, Grimsby and Scotland.

Yet with these vast projects under way, Smiths Insulations Ltd. are still meeting the smaller needs of cold storage facilities required by food distributors and retailers. Their sectional cold rooms of 100 c.ft. upwards fill the bill admirably for storage of modest stocks of fish, meat, ice-cream, fruit and food in general, and their reputation stands high in the quality and workmanship of these small stores.

Behind all these operations is a very thorough knowledge and a forward-looking interest in the many varied aspects of cold storage. Mr. B. T. Smith, managing director of the company, is a leading authority on this subject and he is consulted by some of the largest undertakings in the country when new schemes are planned.

The result is that Smiths Insulations Ltd. have won their rightful place in the forefront of the industry, as insulation engineers, cold store designers and contractors, and they are qualified to undertake entire responsibility for the design and construction of any cold storage project, whatever its size.

STYRENE PRODUCTS LTD.

DURING the past decade the refrigeration industry has perhaps made more demands on plastics materials than any other industry. Designers in the industry seem to have grasped more quickly than designers in other fields the potentialities of plastics over traditional materials. As

Many of the users of S.G. Gilled Tubing are the giants of their respective industries—household names in Heating, Refrigeration, Engineering. Surely there's a reason?

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Or perhaps we just make better gilled tubing at a lower price? S.G. Tubing is supplied with several types of gills, in copper, steel and most ductile metals. Also fabricated into all types of heat transfer equipment to your design, or designed by us for you. Our Technical Dept. is entirely at your service.

SG GILLED TUBING

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TA 9026

more and more designers have specified plastics components in domestic and industrial refrigerators so the manufacturers of raw materials have had to step up their production to meet the demand.

Among the foremost producers of plastics materials in this country are Styrene Products Ltd., since 1955 a member of the Shell organization, and pioneers in the manufacture of raw materials for the refrigeration industry.

Styrene Products began producing polystyrene at their plant at Partington near Manchester in 1950. At the same time Erinoid Ltd., of Stroud, started to market the company's plastics products—an arrangement which continues to the present time.

At the time the Partington plant came on stream the refrigeration industry, which had early recognized the great potentials of the material, was already using fairly large quantities of polystyrene. Most of this had to be imported from America in those days and 90 per cent. of that to be re-exported in the form of finished articles. The injection moulding trade was hungry for indigenous supplies.

Polystyrene found its first application in domestic refrigerators in the manufacture of drip trays, made by the injection moulding method and since these early days polystyrene has continued to be the most widely used plastics material in the industry. Indeed, it is thought that upwards of 15 per cent. of all polystyrene consumed in Britain to-day goes into the manufacture of refrigerator components—by far the largest single outlet for this versatile material.

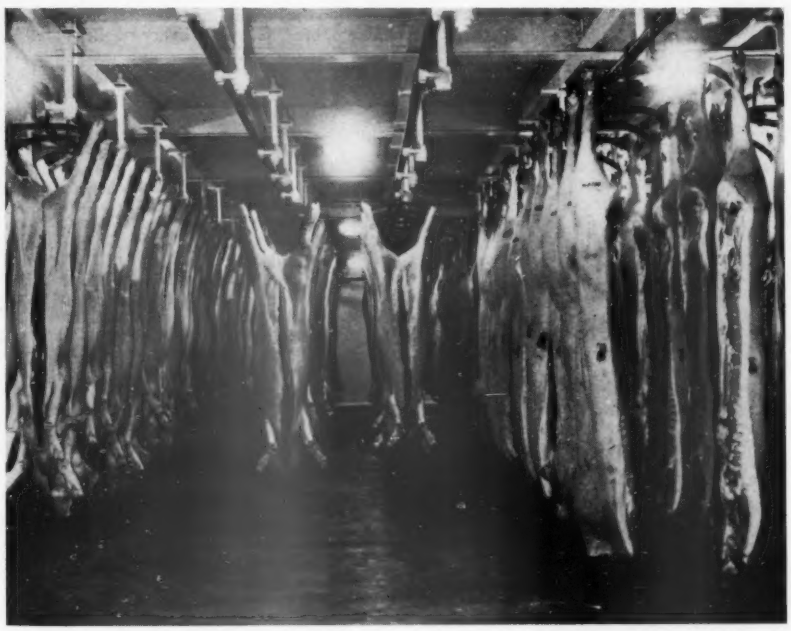
Originally the basic general purpose polystyrene was the only grade available to British manufacturers but during the past few years polystyrene producers have introduced many different grades. Styrene Products have introduced several grades " tailor-made " to suit particular applications called for by the designers. The company now manufactures the following grades :—

1. General purpose polystyrene—grade KLP.
2. A high molecular weight grade of polystyrene which gives added strength and retains its crystal clarity—grade CL.
3. A heat-resistant material with a softening point of 100° to 103° C. (by BS 1493)—grade HS.
4. A combination of the above two grades combining the properties of both—grade 2CL/HS.
5. A high-impact polystyrene—grade CP 20.
6. Heat-resistant high-impact polystyrene—grade CP 20 HS.
7. Special high-impact material for production of sheet for vacuum forming—grade CP 20 X.
8. Styrene acrylonitrile copolymer which, unlike normal polystyrene grades, resists the effects of petrol and oil, is not stained by tea, coffee and fruit juices and has a greater resistance to scratching—grade ACN/HS.

Polystyrene remains the most economical material for the industry and this advantage combines with excellent thermal and electrical insulating properties, dimensional stability, freedom from taste and smell, unimpaired strength at sub-zero temperatures and resistance to moderately concentrated oxidizing acids, organic acids, chemical soaps, animal and vegetable oils and most alcohols.

The introduction of the tougher grades has meant that larger components can now be made including door liners and inner liners. Bigger refrigerators have naturally called for bigger components and the developments in the vacuum-forming industry, together with the availability of extremely high-impact polystyrene, have made their availability possible.

The size and shape of door liners and inner liners have made them " naturals " for production by the vacuum-forming technique, a method of producing mouldings which is becoming increasingly widespread. This method of forming mouldings entailed slight modifications in the



Cold store at the Letchworth Bacon Co., insulated with "Styrocell" expanded polystyrene manufactured by Styrene Products Ltd.

properties of existing polystyrenes and now the major manufacturers produce grades specially designed for vacuum forming. Styrene Products' high-impact grade CP 20 X, which can be extruded into sheets for vacuum forming, is being used in several makes of refrigerator.

Sheet is also playing its part in the industrial and commercial field as panels in the construction of large industrial refrigerators.

One of Styrene Products' latest developments of special interest to the refrigeration industry is the production of a completely different form of polystyrene—" Styrocell " expandable polystyrene, a modified moulding powder incorporating an expanding agent which, when sufficient heat is applied to the powder, expands the polystyrene beads to anything up to 80 times their original size.

Blocks of this expanded material are being used in the insulation of cold store rooms, large commercial refrigerators, refrigerated vans and lorries and in many other refrigeration applications. The blocks are extremely light (" Styrocell " has a density down to 1 lb. per c.ft.) and are rot-proof and contain nothing of food value to vermin. Already these blocks are taking the place of cork and glass wool in commercial refrigerators and in a few applications in the domestic field.

When one considers the revolutionary changes in refrigerator design and use of raw materials in recent years it is not improbable to visualize the era of the " all-plastics " refrigerator.

W. A. TAYLOR LIMITED

" Taylor's of Mitcham," is a company whose imprints are to be found in many parts of the world, and cold stores insulated, and equipment supplied, bear the stamp of craftsmanship and tradition.

To go back to origins means ranging over the whole history of industrial and commercial refrigeration as we know it today. In 1890, the late Thomas Taylor, a builder, became associated with one of the great names in refrigeration, Louis Sterne, and carried out insulation contracts in various parts of the world, notably in Czarist Russia, the old Austrian Empire, France, and Belgium.

These were great days of pioneering achievement, when sawdust, charcoal, and later granulated cork, were the principal means of insulation, and the carpenter and joiner were the joint kings of this new craft. Slab cork was to follow later, but in the meantime many large cold stores, some of which survive as economic units today, were constructed.

Thomas Taylor was later joined by a robust and picturesque figure, the late Mr. Kensett, whose broad Stetson hats and wild west manner became well known in refrigeration circles. The retirement of Mr. Kensett was followed shortly by the death of Thomas Taylor, and in a few years the new style of W. A. Taylor Ltd. was adopted under the late William Albert Taylor, who continued the tradition of his father, and was responsible for many notable insulation contracts, as, for example, The London Ice Company, the new Hibernia Wharf for the Proprietors of Hays Wharf Ltd., the first ice skating rink in London for Messrs. Lightfoot, and the large meat works in Ireland.

The old Linde Company, later to become the Lightfoot Refrigeration Co. Ltd., made considerable use of this company's services, and their various factories at Bedford, Brighton, and Worthing, were Taylor-insulated. Names now extinguished, but well remembered, such as Haslam & Newton Ltd., the Kirkaldy Company, H. J. West Ltd., and the Liverpool Refrigeration Company Ltd., all figure in the books of the firm of Taylor, and these eminent companies of their day were responsible for much of the development of the modern practice of refrigeration.

The modern structure of the heavy industry is made up of the three great names which date from the earliest times, and Taylor's of Mitcham still enjoy the confidence of these companies, along with that of the comparatively modern organizations which arose between the wars.

So much for the history of people and organizations, and the history of techniques, materials, and even developments in insulation, is no less fascinating.

Of the originals, sawdust, silicate of cotton, shards from sugar cane refinery, charcoal, chaff, and sand, have all had their day as a means of insulation, while granulated cork as a loose packing alone survives in limited use. The development of Africa brought kapok and vermiculite to the industry, and expanded ebonite pioneered the way for wholly manufactured slabs, to be followed by the poly groups as pure synthesis in slab form, offering advantages over a limited range. All sorts of materials are being combined in an attempt to find the ideal and the equilibrium, and to gain a home produced material, but they have far to go.

Insulation clearly demands consideration of every type of application, and if the temperature range and duty, especially the time factor, is considered, the weight of the material becomes important. An office insulated with a material at 8-lb per c.ft. is a monstrous project in summer without air-conditioning, while a large cold store built with material at between two and three pounds, is equally out of balance.

Of all the materials in general use, slab cork has since 1913, been in general use, and still commands the market for main industrial uses.

The smaller commercial applications make use of a great variety of insulation media, and the processes of manufacture lend themselves more readily to light weight and fragile material.

The assessment of fire risk is an element requiring a clear mind, and absence of bias, and a most comprehensive knowledge of all the details of refrigeration, insulation and building technique, and the fact emerges that an insulator must know as much about building construction as insulation.

The use of metal is now an important side of insulation practice, and joinery has become a fully mechanised business, requiring expensive and accurate machines, with highly skilled operatives. Finishes to insulation in small commercial work is a simple matter of choice over a very wide range, but even here knowledge is indispensable, and the value of complete inertness is paramount. The progress from naturally inert material provided ready-made by nature, to a form of synthesis, must of necessity be slow and painful, but it is already established as an idea, and will doubtless develop.

The composition of Taylor's of Mitcham today is modern and democratic, with Mr. R. Saunders (who joined the company in 1926) as chairman and managing director. On the board also are two members who have come up from the works, and the old tradition that " the job comes first " is well maintained. Labour relations are on a sound basis in line with modern requirements.

New advances in intricate simulation gear call for insulation knowledge of a rare kind, and Taylor's of Mitcham are rapidly incorporating this new element into their tradition.

Along with high standards, and a refusal to lower them, this company has also pioneered several important new techniques in insulation, such as the building of simulation equipment, and examples will be found in most of the large aircraft manufacturing and research establishments, of odd looking apparatus which helps to bring about artificial conditions over an amazing range, and without any apparent ageing.

In apparatus where speed of temperature change is the most important factor, insulation may play the star role, and can in fact make or mar the whole range of experiments. This practice is one of the company's important developments and in the range of industrial and commercial applications, such recent contracts as Selfridges, Chambers Wharf, and Southampton Docks Cold Store, speak for themselves.

REFRIGERATION PATENTS

These new refrigerating patents have been specially selected for readers by MODERN REFRIGERATION from the Official *Journal of Patents*, and are published by permission of the Controller of H.M. Stationery Office.

APPLICATIONS RECEIVED

February 28—Betts, D. M., P6594, Ice dispensing unit ; General Motors Corporation, C6525, Refrigerator. March 4—Babcock & Wilcox Ltd., Dryden, T. F., and Miller, J. M., P6942, Thermal insulation. 5—Carrier Engineering Co., Ltd., C7100, Air-conditioning control. 6—Auto-Vap Air-Conditioners, Ltd., Masrieh, M. M., Perry A. E., C7320, Cooling device. 11—Carrier Engineering Co., Ltd., C7824, Absorption refrigeration systems ; Soc. Anon. Frigeco., C7851, Refrigeration apparatus. 13—Dole Refrigerating Co., C8101, Refrigerated vehicles. 14—Adam Opel Akt.-Ges. C8254, Refrigerator. 17—Borg-Warner Corporation, C8542, Ice-making machine. 18—Suddeutsche Kuhlerfabrik Julius Fr. Behr. C8690, Air-conditioning appliance. 21—Garrett Corporation, C9150, Air-conditioning system ; Primore Sales, Inc., C9055, Refrigeration system ; Vyzkumny Ustav Stroju Chiadicich A Polravinarskych. Polak, V. C9126, Refrigeration plant compressor regulating method ; C7127, Refrigeration plant. 24—Knibb, L. H., C9347, Ice cream freezer. 25—Schofield, C. S., P9569, Refrigerated bottles, etc., dispensing apparatus.

COMPLETE SPECIFICATIONS ACCEPTED

March 19—Wilmot-Breeden Ltd., 795,122, Fastening for a refrigerator or like door ; Pressed Steel Co., Ltd., 795,016, Evaporator for refrigerators ; Whirlpool-Seeger Corporation, 795,029, Refrigerated cabinets. 26—General Electric Co., 795,435 Magnetic latches suitable for refrigerator doors. April 10—Pressed Steel Co. Ltd., 795,981, Refrigerator cabinets ; General Motors Corporation, 796,202, Thermal insulation for refrigerators. 16—Carrier Engineering Co., Ltd., 796,293, Gas compression means and refrigeration systems ; Ashcroft, G. R., 796,437, Cold storage cabinets ; Garrett Corporation, 796,527, Control apparatus for air-conditioning means.

New Companies

The accompanying particulars of New Companies recently registered are taken from the Daily Register compiled by Messrs. Jordan and Sons Ltd.

Domestic Heating Development Ltd., 41, North John Street, Liverpool, 2. Secretary : A. H. Walker. To carry on business of heating and air-conditioning engineers, etc. Capital : £100. Directors : Frederick W. Sprooles, 39, Southport Road, Liverpool ; Archibald H. Walker, White Gates, Birkenhead Road, Hoylake, Wirral. Registered by H. T. Woodrow & Co. Ltd.

Refrigerator and Electric Appliance Ltd., 2, Grasmore Road, Blackpool. Capital : £100. Directors : Stanley Brooks, 22 Ansdell Road, North, Lytham St. Annes ; Ethel Brooks, 4, St. Patricks Road, South, Lytham St. Annes. Registered by Jordan & Sons Ltd.

William Kenyon & Sons (Thermal Insulations) Ltd., Stamford Garage, Old Street, Ashton-under-Lyne, Lancs. To take over the business of thermal insulating engineers being part of the business carried on at Dukinfield, Ches., by William Kenyon & Sons Ltd., etc. Capital : £175,000 Directors : Theodore Robson, "Hillside," Yew Tree Brow, Blackburn ; William Pennington, 259, King Street, Dukinfield ; George H. Kenyon, Charles E. C. Bickerdike, James L. Jepson, Ronald A. Mansergh and Anthony R. Jacks. Secretary : N. Smethurst. Solicitors : Knott Castle and Wrigley Claydon, Manchester, 2. Registered by Shaw & Sons Ltd.

Auto-Ice Ltd. To carry on business of manufacturers of and dealers in refrigerators, ice making machines, etc. Capital : £1,000. Secretary : H. Harris. Directors : Norman L. S. Hay and Donald P. H. Josephs. Subscribers : Harry Harris, 18, Brockley Avenue, Stanmore, Middlesex (clk) ; David C. Martin, 108, Fleetwood Road, Dollis Hill, N.10 (clk). Registered by Rooke, Holt & Co., 83, Ebury Street, S.W.1.

D. & J. Messer (Electrical) Ltd., 6, Gate Street, W.C.2. Secretary : Eva L. Gaskin. To carry on business of electrical, radio, television and refrigeration engineers and contractors, etc. Capital : £500. Directors : Dennis J. Messer, 48, Jeymer Drive, Greenford, Middlesex ; John W. Messer, 56, Millet Road, Greenford, Middlesex. Registered by Stanley, Dean & Co. Ltd.

Express Refrigeration Ltd., 364, Clapham Road, S.W.9. Secretary : Daisy I. Harris. To carry on business of manufacturers of refrigeration equipment, etc. Capital : £1,000. Directors : William C. Harris & Donald C. Harris, 4, Broadview Road, S.W.16. Registered by H. A. Just & Co. Ltd.

Magi Master Ltd., 8/10, Lyons Place, St. Marylebone, N.W.8. Secretary : Joan B. Parvin. To carry on business of retailers and wholesalers of and dealers in electrical apparatus, including refrigerators, vacuum and washing machines, etc. Capital : £1,000. Directors David Jackson, 292, Dollis Hill Lane, N.W.2. ; Albert L. Crowe, 23, Talbot Road, Bayswater, W.2 ; John Parvin, 36, Sidney Road, Beckenham. Registered by Paisner & Co., W.C.1.

Sicily

Messrs. C.I.F.A.M., Via T. Cannizzaro 51/A, Messina (Sicily), have informed the British consulate at Palermo that they would like to import direct from the United Kingdom sealed compressor units for refrigerators. C.I.F.A.M. (Compagnia Italiana Frigoriferi Arredamenti Moderni), who are manufacturers of refrigerators for groceries, butchers and other food trades, are considered to be a suitable connexion for United Kingdom firms. Manufacturers interested in this enquiry should write direct to the Sicilian concern. It would be appreciated if, at the same time, they would copy their initial letters to the British Consulate, Via Caltanisetta 1, Palermo.

'MR' small ads

Prepayment of Classified advts. is requested.

Replies to Box No. advts. to be addressed to Box No.——, MODERN REFRIGERATION, Maclaren House, 131 Great Suffolk Street, London, S.E.1.

AGENCIES REPRESENTATIVES, ETC.

6d. per word. Minimum **12/6.** Box **2/-** extra.

COMMERCIAL Refrigeration Salesman required to cover part of North Hampshire, West Surrey and Thames Valley. Territory already established for many years with leading make of refrigeration plant. Applicant must have several years similar experience and be able to provide proof of earnings above £1,000 per annum for last two years. Apply in writing giving full details of past experience.—Box 967. 967

SITUATIONS WANTED

6d. per word. Minimum **5/-.** Box **2/-** extra.

REFRIGERATION ENGINEER requires appointment with responsibility. Experienced in domestic, commercial, and scientific refrigeration, has specialised in ultra-low temperature equipment as applied to virus storage and desiccation, etc. Also wide experience of air-conditioning.—Box 950. 950

REFRIGERATION Service Manager/Assistant seeks similar position London/North Kent. Age 34, keen and energetic. Full apprenticeship. Conversant with domestic/commercial/industrial equipment.—Box 929. 929

SERVICE Engineer, 4½ years' experience with good educational background wanted, job in London. Age 30 years.—Box 916. 916

SITUATIONS VACANT

6d. per word. Minimum **12/6.** Box **2/-** extra.

AIR Conditioning and Industrial Refrigeration Equipment Manufacturers in Twickenham, Middlesex area, require an experienced and skilled man to take control of department responsible for erecting equipment. Apply in first instance to Box 955. 955

CHANNEL ISLANDS. An experienced engineer required for the installation and maintenance of York commercial refrigeration and various Domestics and sound knowledge of electrical installations. An opportunity to work and live in pleasant surroundings at a low Income Tax level. Write in the first instance giving details of all experience and employment to Tele-Frige, 73, New Street, St. Helier, Jersey, C.I. 965

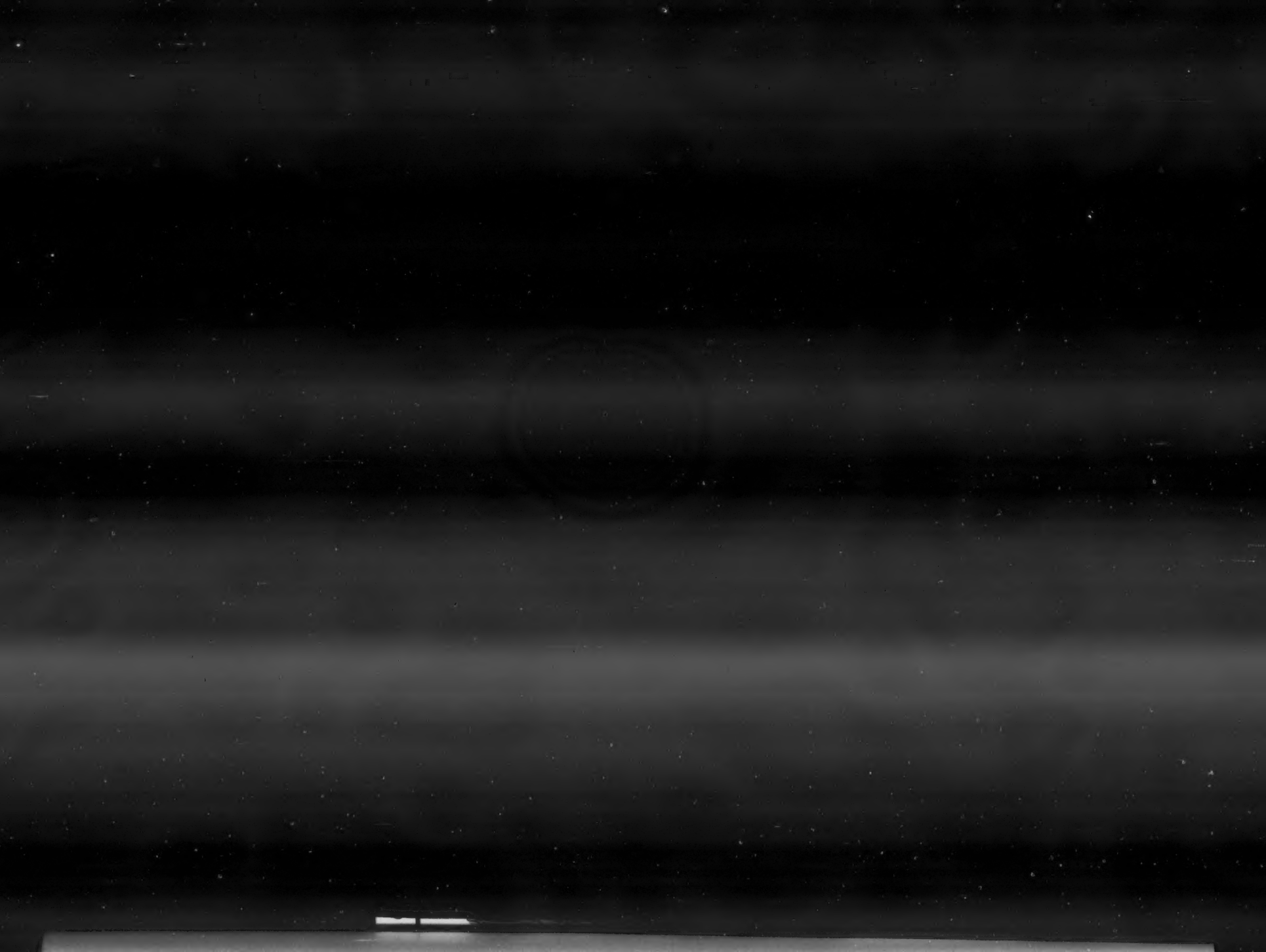
DRAUGHTSMAN. Vacancy for an experienced man with knowledge of Refrigeration. Permanent position. Pension scheme in operation, canteen. Good working conditions. Expenses paid for interview.—Wm. Douglas & Sons Ltd., Douglas Wharf, Putney Bridge, S.W.15. 899

EDITORIAL ASSISTANT. A nationally known company located in the southern half of England, require the services of an Editorial Assistant to work under the Editor of their Press and House Journal department. The company require a qualified writer able to produce semi-technical articles for Trade Press and business house Journals. Previous journalistic and Sales Promotion experience coupled with a knowledge of the preparation of material for printers will be of advantage. Some knowledge of Refrigeration Equipment is desirable but not essential. Age bracket preferably 28-40. Pension scheme and five-day week in operation. Apply in writing giving full details of age, experience, qualifications and salary required to Box D8635, c/o Whites, 72, Fleet Street, E.C.4. 943

FULLY qualified refrigeration engineer required for operation in the Exeter area.—C. Buswell & Sons Ltd., Torquay. 962

R. GORDON (KINGSTON) LTD., J. & E. Hall Ltd., Agents, require Service Engineers with commercial refrigeration experience. Top rates paid plus commissions. Applications treated confidentially. Write, call or telephone, 51, Cambridge Road, Kingston-upon-Thames. Kingston 5141. 927

REFRIGERATION Applications Engineer for a progressive and expanding firm of Refrigeration Engineers situated in the Greater London Area. Must be capable of handling enquiries up to 10 h.p. Reply giving full particulars of experience and salary required. Our staff have been informed of this advertisement.—Box 961. 961

REFRIGERATION Design Engineer. Must be qualified senior man with experience in design of wide range of Refrigeration Cabinets, coldrooms and various equipment up to 10 h.p. Top salary will be paid to responsible person with initiative and there is ample opportunity for advancement. Apply giving full particulars to—Marco Refrigerators Ltd., Rowan Road, London, S.W.16. 573

REFRIGERATION ENGINEERS required by KELVINATOR LTD. for maintenance and installation work in the Greater London area. Good salaries and conditions with Pension Scheme are offered to suitable applicants. Apply to Personnel Officer, Kelvinator Ltd., Hudson Motors Building, Great West Road, London, W.4. 928